



NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

Centre for System Design

POST SRINIVASNAGAR, MANGALORE – 575 025

Phone: (0824) 2474000

Fax: (0824) 2474033

E- mail: info@nitk.ac.in

Website: <http://www.nitk.ac.in>

Tender Notification. No : NITK/CSD/KVG/Hyperws/2019/PU-04AA

Date: 24-06-2019

Tender Extension Notice

The tender submission due date of Notification No. NITK/CSD/TPEM/19/Hyperws/2019/PU-04A dated 10-06-2019 has been extended upto 08-07-2019 at 03:00 PM. The date of opening of tender is 09-07-2019 at 03:30 PM. All other conditions in the tender will remain unchanged.

Sd/-
Coordinator



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Tender Notification. No : NITK/CSD/KVG/Hyperws/2019/04A

Date: 10-06-2019

Tender Extension Notice

The tender submission due date of Notification No. NITK/CSD/TPEM/19/Hyperws/2019/04 dated 03-05-2019 has been extended upto 24-06-2019 at 03:00 PM. The date of opening of tender is 25-06-2019 at 03:30 PM. All other conditions in the tender will remain unchanged.

Sd/-
Coordinator

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL**Centre for System Design, NITK Surathkal**

POST SRINIVASNAGAR, MANGALORE – 575 025 (D K)

A DEEMED UNIVERSITY

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Website: <http://www.nitk.ac.in>**TENDER DOCUMENT**

Tender Notification . No. NITK/CSD/TPM//2019/Hyperworks/PU-04 Date: 03-05-2019

Name of Goods	: HYPERWORKS
Estimated amount put to Tender	: Rs. 67 Lakhs
E M D Amount	: Rs. 1,34,000/-
Time for Supply of item after release of Purchase order	: 30 Days.
Last Date for submission of tender	: 24-05-2019 before 3.00 PM
Address for Submission of Tender	: Dr. Pruthviraj U, Asst. Professor, Dept. of Applied Mechanics & Hydraulics, NITK Surathkal – 575025 Ph: 0824-2474000 Extn: 3313. (M): 9972797225, pruthviu@nitk.edu.in
Date of opening of technical bid	:. 24-05-2019 at 3.30 PM (if possible)



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Tender Notificatin.No : NITK/CSD/TPem//2019/Hyperworks/PU-04

Date: 03-05-2019

NOTICE INVITING TENDER (NIT)

The National Institute of Technology Karnataka, Surathkal (in short – NITK, Surathkal) is an autonomous body under Ministry of HRD Govt of India , a Deemed University , imparting Technical Education and engaged in Research Activities. It is proposed to procure the items for the departmental academic/research activities.

Sealed Tenders are invited for the following items in **two cover system** (i.e., Technical bid and financial bid) subject to the following terms and conditions, from the reputed manufacturers or its authorised dealers so as to reach this office on or before scheduled date and time. The tender (Technical bid) will be opened on the same day if possible in the presence of bidders or their authorized agents who may choose to be present. The financial bid of only such bidders whose technical bid is accepted shall be opened on the same day or later pre-informed date.

1. Name of Goods : HYPERWORKS

2. Estimated Cost : Rs. 67 Lakhs (Rupees Sixty seven lakhs)

3. E M D : Rs. 1,34,000/- (Rupees One Lakh thirty four thousand)

4. Time for completion of Supply after Placing Purchase Order : 30 days

5. Last date at time for submission of Tender : 24-05-2019 before 03:00 PM

6. Tender to be submitted at the following address : Dr. Pruthviraj U,
Asst. Professor,
Dept. of Applied Mechanics & Hydraulics,
NITK Surathkal – 575025
Ph: 0824-2474000 Extn: 3313.
(M): 9972797225

7. Place, Date and Time of opening of technical bid:

Date : 24-05-2019

Time : 03:30 PM

VENUE: Dean P&D Office

Note: Institute shall not be responsible for any postal delay about non-receipt /non delivery of the bids or due to wrong addressee.

Sd/-

[Signature of Coordinator With Seal]

SECTION 1 : INSTRUCTION TO BIDDER (ITB)

1. The bid should be submitted in two cover system-Technical Bid and Financial Bid:

1.1 Envelope No.1 – Technical Bid: The agencies should give details of their technical soundness and provide list of customers of previous supply of similar items to Universities, Institutes or Government Departments/ Undertakings/ public sectors with contact details. The details of the agency/ profile should be furnished along with the copy of all related documents. This envelope should be sealed and duly superscribed as “**Envelope No. 1 – Technical Bid**”. Full name and address of the agency should also be mentioned on envelope and should be addressed to The Director, NITK, Surathkal.

1.2. Documents to be submitted in the technical bid :

- a) The agency should possess Licence certificate for manufacture /supply of the item.
- b) List of Owner/partners of the firm and their contact numbers
- c) The agency should possess Income tax PAN number.
- d) The agency should possess VAT registration and TIN number.
- e) Catalogue of the Product with detailed product specifications.
- f) List Service Centres
- g) List of customers with contact details.
- h) The average annual turnover should not be less than 30% of the estimated cost put to tender/quotation for the job work. The copy of the Balance sheet, Profit & Loss A/c., Trade or Manufacturing A/c for the last 3 years should be enclosed
- i) **Warranty Period Offered for the tendered item to be specified. If the Warranty period is not conforming with the schedule of requirements given in section 3 of the document, the bid is liable to be treated as non-responsive and rejected.**
- j) **EMD in original form valid for minimum six months, through Bank Guarantee only drawn on any scheduled bank in favour of “Director NITK, Surathkal”, payable at Surathkal should be submitted. EMD shall bear no interest. Any bid not accompanying with EMD is liable to be treated as non-responsive and rejected.**
- k) **Contract form given in section 5 need to be submitted.**

The above documents should be furnished in the technical bid envelope.

2. Envelope No.2 – Financial bid: The agencies should submit their financial bid as per the format given in Section 4 of the Notice Inviting Tender in this cover. The rate should be quoted both in words and figures. All the pages of the financial bid should be signed affixing the seal. All corrections and overwriting should be initialled. This envelope should be duly superscribed as “**Envelope No. 2 – Financial bid**”. Full name and address of the agency should also be mentioned on the envelope and should be addressed to The Director, NITK, Surathkal.

Both the Envelope No. 1 and 2 should be kept in another separate envelope duly superscribed with the following details.

(i) Tender Notification Number (ii) " Tender for the supply of.....", (iii) Not to Open before (Date and Time)

Mention “Kind Attention : Contact Person’s Name and Phone Number ”, and submit at the address given in the Notice Inviting Tender.

3 The tender will be acceptable only from the **manufacturers or its authorised supplier.**

4. The Institute **reserves the right to visit to the factory** before or after issue of supply order to satisfy itself regarding quality of production . In case of any remarks /default noted, the EMD will be forfeited even if pre-qualified.
5. **The Financial bid shall be in the format of Price Schedule given in Section 4. The Contract form as per format given in section 5 shall be submitted. Incomplete or conditional tender will be rejected.**
6. Details of item to be carried out, approximate quantity and the specifications are mentioned in “**Section 3**” appended to this Notice Inviting Tender.
7. **The item to be used is strictly according to the specification and subject to test by the institute/concerned authorities. It must be delivered and installed in good working condition.**
8. The Institute **reserves the right to cancel or reduce the quantity** included in the schedule of requirements at any time after acceptance of the tender with a notice. The Contractor/Supplier shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the work/supply in full but he did not derive in consequence of the foreclosure of the whole or part of the works.
9. **Performance Security of 5 % of contract value in terms of Bank Guarantee by scheduled banks shall be given by the successful bidder for the total period of Warranty.**
9. **Release of EMD :** The EMD shall be released after receipt of performance security from successful bidder.
- 11 **Validity of bids:** The rate quoted should be valid for a minimum of 90 days.
No claim for escalation of rate will be considered after opening the Tender.
12. **Imports: In case, Goods are to be Imported, the Indian agent should furnish authorisation certificate by the principles abroad for submission of the bid in response to this Notice Inviting Tender.**
13. Clarification of Tender Document:
A prospective bidder requiring any clarification of the Tender Document may communicate to the contact person given in this notice inviting tender. The contact person will respond to any request for clarification for the Tender Document received not later than 5 working days prior to the last date for the receipt of bids
14. Amendment of Tender document: At any time prior to the last date for receipt of bids, Institute may for any reason, whether at its own initiative or in response to a clarification requested by prospective bidder, modify the Tender document by an amendment.
15. **Institute may at its own discretion extend the last date for the receipt of bids.**
16. The bids shall be written in English language and any information printed in other language shall be accompanied by an English translation, in which case for the purpose of interpretation of the bid , the English translation shall govern.

17. The Institute reserves the right of accepting any bid other than the lowest or even rejecting all the bids. The decision of the Institute Purchase Committee is final in all matters of tender and purchase.
18. The bidder should give the following declaration while submitting the Tender.

DECLARATION

I/we have not tampered/modified the tender forms in any manner. In case , if the same is found to be tampered/modified, I /we understand that my/our tender will be summarily rejected and full Earnest money deposit will be forfeited and I /we am/are liable to be banned from doing business with NITK, Surathkal and / or prosecuted.

Signature of the Bidder : _____

Name and Designation : _____

Business Address : _____

Place :

Seal of the Bidder's Firm

Date :

19. Any other details required may be obtained from the contact person given in the notice inviting tender during the office hours.

SECTION 2 : CONDITIONS OF CONTRACT.

1. The rates should be quoted for preferably FOR destination from supply within India.
2. In case of import both CIF and/ or FOB rate should be quoted. All components of expenditure to arrive at Bangalore need to be explicitly specified.
3. The bidder shall indicate the excise duty exemption for the goods if applicable.
4. The institute is eligible for customs duty exemption, excise duty exemption, issuance of form D.
5. The rate quoted should be on unit basis. Taxes and other charges should be quoted separately, considering exemptions if any.
6. Rate quoted should be inclusive of Testing, commissioning and Installation of equipment and Training.
7. Payment: No advance payment will be made. Payment will be made only after the supply of the item in good and satisfactory condition and receipt of performance security by supplier.
In case of Imports, the payment will be made through LC / Sight Draft / After Installation, and performance security need to be submitted at the time of LC commitment / issue of sight draft.
8. Guarantee and Warrantee period should be specified for the complete period conforming to the section 3 of this tender document.
9. Period requirement for the supply and installation of item should be specified conforming to the section 3 of this tender document.
10. In case of dispute, the matter will be subject to Mangalore Jurisdiction only.

SECTION 3 : SCHEDULE OF REQUIREMENTS, SPECIFICATIONS AND ALLIED DETAILS

[To be filled up by the Department / Center of NITK, Surathkal]

Item(s) Name to be Procured	: HYPERWORKS
Type (Equipment / Software / Furniture / Others)	: Equipment
Brief Specifications of the Item(s) (Attach Additional Sheet if necessary)	: Attached
Quantity	: 4 No.s (3+1) HyperWorks Research/Academic License (Qty: 3 Concurrent academic- end user license agreement) <i>installed at NITK Surathkal.</i> HyperWorks (Qty: 1 Concurrent commercial - end user license agreement) <i>installed at Aditya Auto Products & Engineering (India) Private Limited, Bangalore</i>
Any other details / requirement	: Nil
Warranty Period required	: 1 Year (Free technical support & upgrade)
Delivery Schedule expected after release of Purchase order (in Weeks)	: 30 days
EMD (in Rupees)	: 2% of Estimated cost
Performance Security to be given by Successful Bidder after release of Purchase Order (in Rupees)	: 5% of Cost

SECTION 4 : PRICE SCHEDULE

[To be used by the bidder for submission of the bid]

-
- | | | |
|-----|---|---|
| 1. | Item Name | : |
| 2. | Specifications
(Conforming to Section 3 of
Tender document- Enclose additional
sheets if necessary) | : |
| 3. | Currency and Unit Price | : |
| 4. | Quantity | : |
| 5. | Item Cost (Sl No. 3 * Sl. No. 4) | : |
| 6. | Taxes and Other Charges
(i) Specify the type of taxes and duties
in percentages and also in figures.
(ii) Specify Other Charges in figures. | : |
| 7. | Warranty Period
(Conforming to the Section 3 of
Tender document- This should be
mentioned in technical bid also in
order to get qualified for financial bid) | : |
| 8. | Delivery Schedule
(Conforming to the Section 3 of
Tender document | : |
| 9. | Name and address of the Firm for
placing purchase order | : |
| 10. | Name and address of Indian authorized
agent (in case of imports only) | : |

Signature of the Bidder : _____

Name and Designation : _____

Business Address : _____

Place :

Seal of the Bidder's Firm

Date :

SECTION 5 : CONTRACT FORM

[To be provided by the bidder in the business letter head]

1. (Name of the Supplier's Firm) hereby abide to deliver the by the delivery schedule mentioned in the section 3 tender document for supply of the items if the purchase order is awarded.
2. The item will be supplied conforming to the specifications stated in the tender document without any defect and deviations.
3. Warranty will be given for the period mentioned in the tender document and service will be rendered to the satisfaction of NITK, Surathkal during this period.

Signature of the Bidder : _____

Name and Designation : _____

Business Address : _____

Place :

Date :

Seal of the Bidder's Firm

Specifications:

Item Name: HYPERWORKS

Number of licenses required:

1. HyperWorks Research/Academic License (Qty: 3 Concurrent user license) *installed at NITK Surathkal.*
2. HyperWorks (Qty: 1 Concurrent user license) *installed at Aditya Auto Products & Engineering (India) Private Limited, Bangalore.*

Technical Support & Updates: One year.

Detailed Tender Spec for HYPERWORKS:

Modules required:

1. OptiStruct FEA:

Integrated Fast and Large-Scale Eigenvalue Solver: A built-in, standard feature of OptiStruct in an Automated Multi-level Sub-structuring Eigen Solver (AMSES) that can rapidly calculate thousands of modes with millions of degrees of freedom, AMSES, an Eigen solver for Large Models and Large Number of Modes, FASTFR, a Fast Frequency Response Solution.

Advanced NVH Analysis: OptiStruct provides unique and advanced functionality for NVH analysis including one-step TPA (Transfer Path Analysis), Powerflow analysis, model reduction techniques (CMS and CDS super elements), design sensitivities, and an ERP (Equivalent Radiated Power) design criterion to optimize structures for NVH, Radiated Acoustics for SPL and ERP, One Step Analysis PFPATH for Transfer Path analysis and PEAKOUT for Detailed results (Modal, Panel Participation and ODS), Automated workflows for NVH Pre and Post processing for quick Problem Diagnostic, Fast Contact Analysis for Non Linear Contact analysis > 8x faster

SN/EN Fatigue Analysis plus Dang Van Fatigue > to predict for failure in entire life cycle, Spot and Seam Weld Analysis

Robust solver for nonlinear analysis and powertrain durability: OptiStruct has grown to support a comprehensive range of physics for powertrain analysis. This includes solutions for heat transfer, bolt and gasket modeling, hyperelastic materials, and efficient contact algorithms.

Stiffness, Strength and Stability: Linear and nonlinear static analysis with contact and plasticity, large displacement analysis with hyperelastic material, Fast contact analysis, buckling analysis

Noise and Vibrations: Normal modes analysis for real and complex eigenvalue analysis, Direct and modal frequency response analysis, Random response analysis, Response spectrum analysis, Direct and modal transient response analysis, Preloading using nonlinear results for buckling, frequency response, and transient analysis, Rotor dynamics, Coupled fluid-structure (NVH) analysis, AMSES large scale eigenvalue solver, Fast large scale modal solver (FASTFR), Result output at peak response frequencies (PEAKOUT), One-step transfer path analysis (PFPATH), Radiated sound analysis, Frequency-dependent and poro-elastic material properties

Powertrain Durability: 1D and 3D bolt pretension, Gasket modelling, Contact modeling and contact-friendly elements, Plasticity with hardening, Temperature dependent material properties, Domain decomposition.

Heat Transfer Analysis: Linear and nonlinear steady-state analysis, Linear transient analysis, Coupled thermo-mechanical analysis, One-step transient thermal stress analysis, Contact-based thermal analysis

2. Radioss:

Nonlinear explicit dynamic structural analysis

Nonlinear implicit structural analysis

Explicit Computational Fluid Dynamics (CFD)

Euler, Lagrange and Arbitrary Euler-Lagrangian (ALE) formulations

Smoothed-Particle Hydrodynamics (SPH)

Finite Volume Method (FVM) based airbag simulation. Unique solution for accurate airbag deployment.

Pure CFD solution with full coupling with structures.

XFEM for crack propagation in multi-layer shells. High interest in pedestrian impact for windshield rupture prediction (Energy absorption) as well screen behavior under impacts for electronic industry, wash machine cover deck behavior under impacts.

Multi-Domain to manage models with fine meshed components needed to “zoom” for rupture prediction.

This feature is fully compatible with FSI (Fluid Structure Interaction)

Advanced Mass Scaling for quasi-static problems, drop and impact tests to increase the time step and by the way reduce the elapse time significantly without degradation of the accuracy.

Sub-Modeling for local design of components or sub-structures.

Occupant Safety: For vehicle occupant safety, simulation RADIOSS has access to a large library of dummies, barriers, and impactors. RADIOSS provides the most comprehensive toolset in the industry through partnerships with Humanetics and CellBond. Coupling with Madymo (TASS) is also possible. In addition, the HyperCrash and HyperMesh modelling environment provides outstanding support for automotive crash and safety simulation.

Scalability: RADIOSS Scales beyond 16000+ Cores, so reduces run time drastically. Allows you to perform many DOEs

Repeatability: Only RADIOSS gives repeatable results, independently of the number of cores, nodes, threats

Industry Leading technique to Speed up the analysis, Advanced Mass Scaling (AMS), Hybrid MPP, Multi-Domain.

3. Motion Solve:

MotionSolve is a scalable and integrated multibody solution that enables user to graphically build systems, numerically solve the underlying equations, evaluate system behavior by examining plots and animations and improve their performance through design exploration and optimization.

MotionSolve models are parametric and they can be built hierarchically. It is possible to create libraries of parametric subsystems and reuse these to build system model. MotionSolve has been developed in partnership with customers. So, it has been thoroughly validated on real models for ease-of-use, scalability, accuracy, robustness and speed.

MotionSolve is an open solution. It is possible to include flexibility effects by importing modal representations of finite element models, co-simulate with controls software and 1-D simulators that contain non-mechanical subsystems, include FMUs developed by third-party solution providers and connect to CFD codes to account for accurate aerodynamic forces. At the user interface level, GUIs can be self-created to instantiate systems and subsystems that were created. At the solver level it is possible to customize the physics of the model. Both the solver and the GUI have well-documented interfaces that allow customization and extend the solution.

MotionSolve offers powerful capabilities for multi-disciplinary simulations for system level analyses such as kinematics and dynamics, statics and quasi-statics, linear and vibration studies, effort estimation, vehicle dynamics, low frequency NVH and packaging synthesis. It also computes the necessary inputs for performing component strength calculations, weight minimization and fatigue life prediction.

The documented interface for MotionSolve has been used to develop a large set of custom tools for the automotive and heavy truck industries. The custom tools support:

- Higher level modelling entities that describe parametric components and subsystems
- System definition and assembly
- Custom events that perform K&C studies, vehicle dynamics and rough road durability evaluations
- Automatic report generation for all events
- Design exploration with model and event variants.

MotionSolve has been successfully used in the automotive, aerospace, general machinery, white goods, packaging, heavy industry and wind energy industries.

Model Building: 2D / 3D Rigid bodies, Linear or nonlinear flexible bodies, Joints with limits, backlash and friction, Higher pair joints on rigid or flexible bodies, 2D/3D contact between general geometries with friction, Nonlinear 1D / 3D / 6D forces, Beams, bushings and fields, Linear/nonlinear state equations and transfer functions, User subroutines.

Simulation & Analysis: Assemble a system to satisfy all its constraints, Kinematic and inverse kinematic analysis, Static Equilibrium, Quasi-static and steady state solutions, Nonlinear, time domain dynamics simulations, Eigenvalue and Eigenvector calculation, Transfer function analysis given inputs and outputs, Scripted simulations; commands to modify the model, General purpose co-simulation.

Results Evaluation: 2D / 3D plotting, Signal processing and filtering, Curve fitting, Statistical analysis, Data inspection, Time domain animations with deformation, Contours plots, linear animations, Report Generation.

Design Exploration & Optimization: Design of experiments (DOE) Response Surface Method (Fit), Single or multi-objective optimization, Reliability based design optimization, Robustness based design optimization, Stochastic Simulation, Post-processing, Data mining, Cloud solutions.

4. AcuSolve:

Built upon a rigorous scientific foundation, AcuSolve is a proven asset for companies looking to explore their designs. AcuSolve provides powerful fluid flow analysis capabilities without the difficulties associated with traditional CFD applications. Acusolve is a finite element based solver, as it is node based, it takes less time for solving.

Capabilities

Solver Technology - Fast and Accurate: Fully coupled pressure/velocity solver for all supported flow regimes, Fully coupled temperature/flow solver for highly buoyant flows, All features supported with distributed, shared, and hybrid message passing modes, 2nd order spatial accuracy for all unstructured element topologies: 4-node tetrahedron, 5-node pyramid, 6-node wedge, 8-node brick, 2nd order accurate time integration for transient simulations.

Flow and Heat Transfer: Incompressible and sub-sonic compressible Stokes and Navier-Stokes equation, Multi-species transport equations, 2 fluid immiscible multiphase model with interface tracking, Viscoelastic Material Modeling, Thermal transport and conjugate heat transfer, Multi-layered thermal shell equations, Gray body enclosure radiation model with parallel view factor calculation, Solar radiation model.

Turbulence Models:

Large Eddy Simulation (LES) Models: Dynamic LES model, Constant coefficient Smagorinsky LES model. Detached Eddy Simulation (DES) Models: Spalart-Allmaras based Detached Eddy Simulation (DES-1997, DDES, IDDES), SST based Detached Eddy Simulation (SST-DES). Reynolds Averaged Navier-Stokes (RANS) models: Spalart-Allmaras, SST, Wilcox 2006 k- ω , BSL-k- ω , Realizable k- ϵ , RNG k- ϵ , Standard k- ϵ . Turbulent transition models (compatible with Spalart-Allmaras and SST RANS/DES models): γ one-equation model, γ -Re θ two-equation model

Moving Mesh Simulation Technology: Arbitrary Lagrangian Eulerian (ALE) mesh motion, Specified/interpolated mesh motion, free surface mesh movement, Guide surface mesh movement, Non-conformal/sliding mesh interfaces

Multiphysics Capabilities: Rigid body dynamics coupling, Practical Fluid/Structure Interaction (P-FSI), Direct-Coupling Fluid/Structure Interaction (DC-FSI), Direct-Coupled with Multi-body dynamics software MotionSolve®

Computational Aero Acoustics (CAA) Simulations: Integrated Ffowcs-Williams-Hawkings acoustic solver, Support for third party acoustics solver

Powerful User-Defined Function (UDF) Capability: Allows definition of material models, source terms, boundary conditions, etc. Client-server interface with external programs

Particle Tracer: Spherical particle tracing available as post-processing or co-processing step, turbulent diffusion model, Finite mass and massless particles

Component Technology: Fan component, Heat exchange component

5. FEKO:

FEKO is a comprehensive computational electromagnetics (CEM) code used widely in the telecommunications, automobile, and space and defence industries.

FEKO also offers tools that are tailored to solve more challenging EM interactions, including dedicated solvers for characteristic mode analysis (CMA) and bi-directional cables coupling. Special formulations are also included for efficient simulation of integrated windscreen antennas and antenna arrays.

Capabilities

Solver Overview: Time and frequency domain fullwave solvers: MoM, FDTD, FEM and MLFMM, Asymptotic methods: PO, LE-PO, RL-GO, UTD, True hybridization of methods to solve complex and large multi-scale problems, Unique characteristic mode analysis (CMA) solver calculates modal currents, eigenvalues, modal significance and characteristic angles, Dedicated solvers for wave propagation and radio network coverage analysis

Solver Performance Features: The FEKO solver is fully parallelized, and optimized to exploit multi-CPU distributed memory resources, GPU-based solver acceleration, and Optimized out-of-core solver to deliver solutions when RAM limits are reached.

User Interface: State-of-the-art 3D Parasolid CAD modelling interface, including import/export of CAD and mesh formats, Integrated mesh engine for generating triangle, tetrahedron and voxel simulation meshes, Comprehensive post-processing including 1D, 2D 3D plots, import of measurement results, report generation, etc. Full Lua script automation for modeling, configuration and post-processing, with macro recording support.

Optimization: Automated optimization of multi-variable and multi-goal problems with several algorithms, including GA and particle swarm, Real-time monitoring of the optimization process, Interface to HyperStudy

Specialized Solutions: Bi-direction coupling with complex cable bundles and along arbitrary cable paths, Special solver for efficient analysis of antennas integrated into layered windscreens, Efficient methods for finite and infinite arrays and periodic structures, Metamaterials and composites.

Model and Domain Decomposition: Decomposition of some EM problems to reduce computational cost, numerically efficient equivalent sources for complex sources and receivers.

Non-Radiating Networks: Lumped, linear circuit models can be included in a simulation, often used for matching networks, S-, Z- or Y-parameter files or SPICE circuit file Network definitions

Interfaces: CAD and mesh import/export of most major formats, Gerber, ODB++ and 3di for printed circuit boards, Other HyperWorks products including HyperStudy, HyperMesh, Optenni Lab link for automated matching circuit generation, EMIT interface for co-site interference analysis, Imports of CST, Cadence, FEST3D, GRASP and SEMCAD results, Satimo measurements and Touchstone files

6. Flux:

Flux is the leading software for electromagnetic and thermal simulations. With its continuously improving technology, Flux is a versatile, efficient and user-friendly tool that will help to generate optimized and high-performance products, in less time and with fewer prototypes. Together with a highly qualified support network and a strong community of users, Altair and its Flux team provide recognized expertise in electrical engineering.

Capabilities:

High performance geometric description: Embedded sketcher and modeler with fully parametrized modeling constructs, Advanced CAD import & export, Defeaturing & simplification capabilities, A dedicated environment for electric rotating machines design in 2D&3D, Skew modeling capabilities avoiding long 3D analysis.

An easy and flexible mesh generator: Flux™ provides different meshing technologies that can be mixed in both 2D and 3D situations to help the user to quickly get a precise mesh: Smart automatic mesh and fine manual control of mesh size and distribution, Linked mesh between identical geometric entities, Auto-adaptive mesh refinement during solving in 2D & 3D.

Advanced physical properties for high performance calculations: A full range of physical models to simulate the low frequency behavior of electromagnetic devices. Magnetic: Static, steady state AC magnetic, transient, Electric: Electrostatic, conduction, steady-state AC electric, Thermal: Steady state AC thermal, transient, Thermal couplings: Electro-thermal, magneto-thermal, Embedded electric circuits and rigid body motion capabilities.

Advanced modeling techniques for accurate and fast results: Non meshed coils, Thin regions represented by surface models (no need to mesh the thickness), Non-linear anisotropic material behaviour, hysteresis modelling, Skin and proximity losses in windings, Partial Element Electrical Circuit (P.E.E.C.) method for conductor modelling.

Solving process: A fast and robust solver: Fully parametric solver allowing geometrical or physical parameter sweeps, Several iterative or direct linear solvers, Parallel computing using multithreading and distributed memory multiprocessors, Robust non-linear solvers, Distributed parametric studies across several cores or machines. 2D and 3D electromagnetic and thermal solver, Static, transient and frequency domain analysis, Embedded electric circuit coupling, Rotating and linear motion, Connections to other simulation tools for multi-physics or system modelling.

Results post-processing: Flux provides a complete and versatile postprocessor enabling the analysis of results from multi-parametric solving. It gives access to various quantities such as: Potential, flux density, temperature, electric and magnetic fields, Global quantities: magnetic flux, inductances, stored energy, Iron losses, Joule losses in conductors, skin effect visualization, Quantities on electrical components: current, voltage, power, inductance, Extraction of RLC values of conductors and export of equivalent circuits, Mechanical quantities: position, velocity, force, torque, speed

Software Interoperability: Because Flux is used in global design workflows, it can be easily connected to other software, being for multiphysics analysis, optimization or system-level simulation. Flux can also import meshes from SimLab or HyperMesh, allowing to deal with complex 3D CAD input files in an efficient way.

Parametric: easy to use and powerful embedded parametric capabilities. Flexibility: fine mesh control, different models and solvers available depending on the situation, in-depth post-processing PyFluxcommand language allowing to fully automate the use of Flux Built-in scripting tools and user-defined macros.

7. HyperStudy:

- Easy Workflows and Access to multiple FE Input and Solver result readers and efficient Data mining tools for Post Processing
- 8 methods for Screening and Space Filling DOE; MELS, D Optimal and HK are unique DOE methods
- 4 Fitting/Approximations for building Meta/Regression models for efficient prediction. Export the Meta model to Excel for quick design evaluations.
- 10 Optimization methods; RSM, Gradient based, GA and Reliability based methods. GRSM, MOGA, SRO are unique methods.
- 4 sampling methods in Stochastic simulations to assess Reliability. New Machine Learning methods under development.

Design of Experiments: Design of Experiments (DOE) methods in HyperStudy include:

Full factorial Plackett-Burman Central composite design Modified Extensible Lattice Sequence (MELS) Hammersley D-Optimal	Fractional factorial Box-Behnken Latin hypercube User defined and direct input of external run-matrix Taguchi
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The study matrix can consist of continuous or discrete variables that can be either controlled or uncontrolled. DOE studies can be performed using exact simulation or the fit model.

Response Surface Method (Fit): Available response surface methods are:

Least squares regression HyperKriging	Moving least squares Radial basis functions.
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Response surfaces can be used for performing trade-off, DOE, optimization and stochastic studies.

Optimization: HyperStudy’s comprehensive optimization methods solve different types of design problems including multi-objective and reliability/robustness based design optimization. These methods are:

Adaptive response surface method (ARSM) Sequential quadratic programming Genetic algorithm System Reliability Optimization (SRO) Sequential optimization and reliability analyses (SORA) Single loop approach	Method of Feasible Directions (MFD) Global response surface method (GRSM) Multi-objective genetic algorithm ARSM based SORA User-defined optimizer
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Optimization studies can be performed using either exact simulation or fit model. In addition, HyperStudy provides an API to incorporate external optimization algorithms.

Stochastic: The stochastic approach in HyperStudy allows engineers to assess reliability and robustness of designs and provide qualitative guidance to improve and optimize based on these assessments. HyperStudy sampling methods are:

Simple random Hammersley	Latin hypercube Modified Extensible Lattice Sequence (MELS)
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Stochastic studies can be performed using either exact simulation or the fit model.

Post-Processing and Data Mining:

HyperStudy helps engineers to gain a deeper understanding of a design through extensive post-processing and data-mining capabilities. This significantly simplifies the task of studying, sorting and analyzing results. Study results can be post-processed as statistical data, correlation matrices, scatter plots, box plot, interaction effect plots, histograms, and parallel coordinates among others. Furthermore, HyperStudy guides the user in the selection of post processing methods to use based on the design objectives.

8. OptiStruct Optimization:

50+ responses from NV, Durability (LIN and NLIN) and Thermal available for Optimization
Free Shape Optimization for free form shape (plus others, Topology, Topography, Free Size and Gauge)

Semi-Automated 3 Phase Composite Optimization Process from Concept to Detailed Model for Long Fiber Laminated Composites

MMO, a Multi Model with multi Domain/Load case based Optimization

Fail Safe Topology Optimization to design structures which withstand loads if one of the structural members fail during operation

Multi Material Optimization to identify materials/properties for different parts/locations in a system

Integrated Fast and Large Scale Eigenvalue Solver: A built-in, standard feature of OptiStruct in an Automated Multi-level Sub-structuring Eigen Solver (AMSES) that can rapidly calculate thousands of modes with millions of degrees of freedom.

Advanced NVH Analysis: OptiStruct provides unique and advanced functionality for NVH analysis including one-step TPA (Transfer Path Analysis), Powerflow analysis, model reduction techniques (CMS and CDS super elements), design sensitivities, and an ERP (Equivalent Radiated Power) design criterion to optimize structures for NVH.

Robust solver for nonlinear analysis and powertrain durability: OptiStruct has grown to support a comprehensive range of physics for powertrain analysis. This includes solutions for heat transfer, bolt and gasket modeling, hyperelastic materials, and efficient contact algorithms.

Creating Design Concepts:

- **Topology optimization:** OptiStruct uses topology optimization to generate innovative concept design proposals. OptiStruct generates an optimal design proposal based on a user-defined design space, performance targets, and manufacturing constraints. Topology optimization can be applied to 1-D, 2-D and 3-D design spaces.
- **Topography optimization:** For thin-walled structures, beads or swages are often used as reinforcement features. For a given set of bead dimensions, OptiStruct's topography optimization technology will generate innovative design proposals with the optimal bead pattern and location for reinforcement to meet certain performance requirements. Typical applications include panel stiffening and managing frequencies.
- **Free-size optimization:** Free-size optimization is widely applied in finding the optimal thickness distribution in machined metallic structures and identifying the optimal ply shapes in laminate composites. Element thickness per material layer is a design variable in free-size optimization.

Optimization for Design Fine-Tuning

- **Size optimization:** Optimal model parameters such as material properties, cross-sectional dimensions, and gauges can be determined through size optimization.
- **Shape optimization:** Shape optimization is performed to refine an existing design through user-defined shape variables. The shape variables are generated using the morphing technology – HyperMorph – available in [HyperMesh](#).
- **Free-shape optimization:** OptiStruct's proprietary technique for non-parametric shape optimization automatically generates shape variables and determines optimal shape contours based on design requirements. This relieves users from the task of defining shape variables and allows for greater

flexibility for design improvements. Free-shape optimization is very effective in reducing high-stress concentrations.

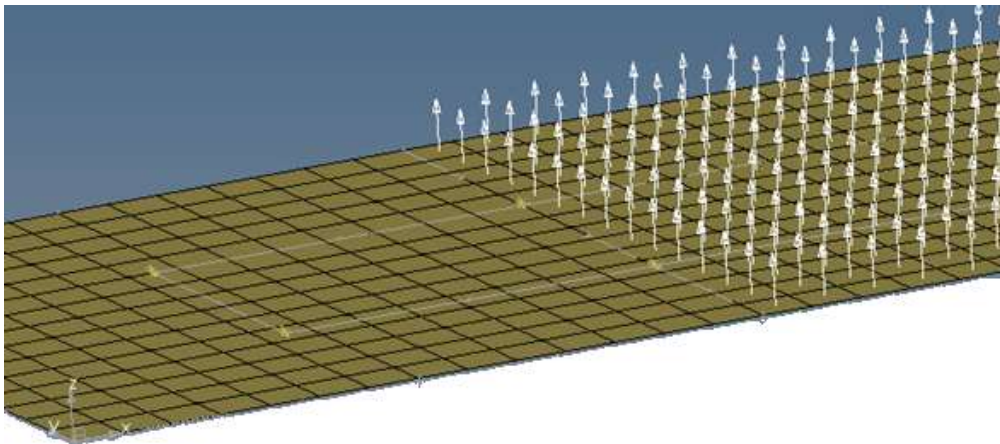
- **Design and Optimization of Laminate Composites:** A unique 3-phase process is implemented in OptiStruct to aid in the design and optimization of laminate composites. The process is based on a natural and easy-to-use ply based modeling approach. This also facilitates incorporating various manufacturing constraints, such as ply drop-off, specific to laminate composite design. Application of this process yields optimal ply shapes (phase 1), optimal number of plies (phase 2) and the optimal ply stacking sequence (phase 3).
- **Design and Optimization of Additively Manufactured Lattice Structures:** Lattice structures offer many desirable characteristics such as lightweight and good thermal properties. They are also highly desirable in biomedical implants due to their porous nature and the ability to facilitate the integration of tissue with the trabecular structure. OptiStruct has a unique solution to design such lattice structures based on topology optimization. Subsequently, large scale sizing optimization studies can be run on the lattice beams while incorporating detailed performance targets such as stress, buckling, displacement and frequency.

9. Aerospace User profile

This profile is aimed to help capture the aerospace model building process and tools necessary for process automation.

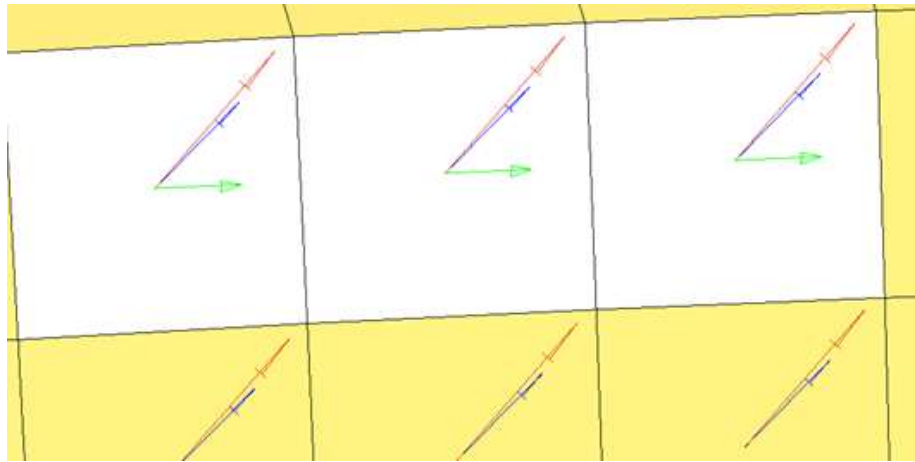
- **Ply Normal Correction to Match the Element Normal**

CAD Systems create different ply stacking directions for each ply stack (laminate). However, solvers can use only single element normal, hence if the ply stack direction and element normal are not matched, ply angles need to be corrected. This utility allows manual ply angle correction depending on the element normal.



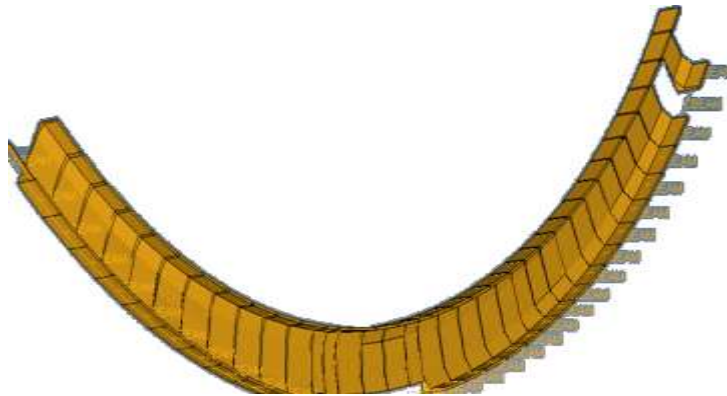
- **Orientation Review**

This functionality is used to display, review and modify frequently used coordinate system for analysis. Element, material and ply systems can be reviewed in a single location and modified. HyperView has similar functionality to make it a uniform user experience.



- **Beam Auto Property Calculation**

This utility automatically calculates beam properties from a solid geometry model or FE model. You can define the FE beam elements and associate with the 3D CAD solid model to automatically retrieve the properties.



- **Ply Geometry Smoothing**

Use this utility to convert FE ply geometry into geometry ply, and export it as STEP files using OS-smooth functions. These STEP files can be imported into CAD systems to recreate the ply. This is a very useful function for composite optimization using OptiStruct and for exporting the geometry for CAD design and manufacturing.

- **Rivet Connector**

This utility connects two components (shell components) using a special aerospace rivet connection method using the Huth formula. This formula results depends on whether the components are composite or metallic.

- **Multiple Ply System**

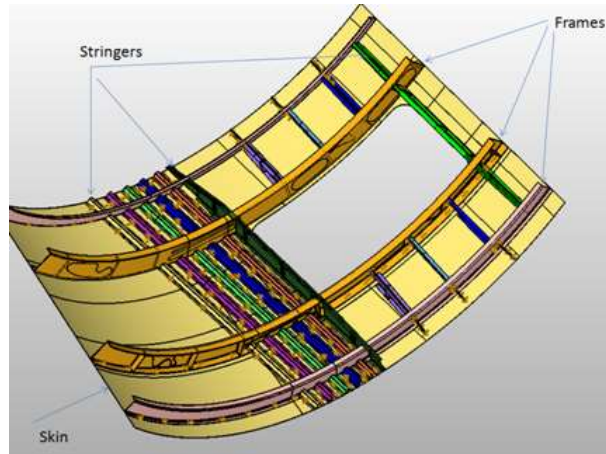
The ply realization algorithm converts the ply angles based on these individual systems to a common system as the solvers currently accepts single material systems for all the plies in each composite property.

- **CATIA Composite Link (Simulyt interface)**

Geometry import/export functionality from CATIA using Catia Composite Link is available. Users need to use the CATIA composite (Simulyt) module, export an HDF5 file, and use that to import the file into HyperMesh using Catia – composite connection. This is similar to the FiberSim import /export method.

- **Airframe Modeling**

This utility automatically creates Aerospace global finite element models (GFEM) from 3D CAD models. The resulting FE model consists of shell elements and 1D beam elements. The shell properties and BEAM properties are automatically derived from CAD models.



- **FE Absorb (Ply Absorb)**

This utility converts zone-based composite models to ply-based models for OptiStruct. PCOMP and PCOMG models are automatically converted to PCOMPP (ply based model).

Features included in HYPERWORKS package

Application	Module/Product	Feature Addition
Modeling and Visualization	HyperMesh	<p>Graphics</p> <ol style="list-style-type: none"> 1.3D Visualization of 1D/2D Elements 2.Property and Material Highlighting 3.By Thickness Visualization Mode 4.By Assembly Visualization Mode 5.Gradient Background 6.Geometry Refinement 7.Shrink Elements 8.Spherical Clipping 9.Element Pre-Highlighting 10.Contact Surfaces Performance 11.Browsers 12.Component View Updates 13.Property View Updates 14.Cross Referencing 15.Include Browser View 16.Tab Tear-off 17.Connector Browser Updates <p>Geometry</p> <ol style="list-style-type: none"> 18.Dimensioning 19.Ruled Solids Functionality 20.Redesigned and Enhanced Geometry Creation Panels 21.Mid-Surface Generation 22.Surface Extend/Trim 23.Meshline Toolkit

		<p>24.New Insert Planes Option for Auto Midsurfacing 25.Solid Trimming with Plane Perpendicular to an Edge 26.Three Node Circle Radius 27.New Lines “by attached” Selection Option</p> <p>Connectors</p> <ol style="list-style-type: none"> 1.Connector Browser 2.Quad Transition Realization Method (Seam and Spot) 3.Ortho Checkbox for ACM Realizations 4.HiLock Realization 5.CFAST Realization 6.Connector Panels 7.New Bolt Realization Type for RADIOSS and Nastran 8.New Seam Realization Types for RADIOSS 9.Autopitch 10.Projection Routine 11.MAT100 (Hexa) Spot Absorption 12.Simple VIP File Import 13.Connector Links 14.NSM Creation via Connectors 15.MCF Import Reader 16.Nodes Listed in RBE3 Element Definitions 17.Mesh Imprint <p>Composites</p> <ol style="list-style-type: none"> 1.Ply and Laminate Entities <p>CAD Readers</p> <ol style="list-style-type: none"> 2.ACIS, CATIA, Parasolid, Pro E and STEP Readers 3.Tribon Reader 4.JT Reader 5.CAD2H3D <p>Meshing</p> <ol style="list-style-type: none"> 6.Quad Only Mesh 7.TetraMeshing 8.Shrink Wrap 9.Node to Surface Associativity 10.Hole Detection Tool 11.OSSmooth Remesh 12.Solid Element Remeshing 13.Midmeshing Tool 14.Thin Solid Meshing 15.CFD Tetramesh 16.OSSmooth 12.0 - Geometry Recovery and Remeshing <p>Batchmesher</p> <p>General</p> <ol style="list-style-type: none"> 1.Browser Include View 2.Cross-reference Browser 3.Box Trim Utility 4.Replace Functionality 5.Model Checker 6.Assign Dialog 7.Check Elements Panel 8.FiberSim Reader 9.Ply Realization Dialog 10.Shortcut Keys 11.Deleting Components 12.Reordering Components
	HyperView	<ol style="list-style-type: none"> 1.Frameworks, GUI 2.Session Browser 3.Result Browser 4.Result Math 5.Video Overlay

		<ul style="list-style-type: none"> 6.Graphic Manipulators 7.CFD - Streamlines 8.Parameter Browser 9.Section Cuts 10.Capture Animation 11.Report Templates 12.Symmetry Visualization 13.3D Stereoscopic View 14.Section Cut with Path Plots 15.Isosurface on Parts 16.Measure Fonts and Colors
	HyperGraph	<ul style="list-style-type: none"> 1.Frameworks, GUI 2.Session Browser 3.MediaView 4.HG Enabling Units 5.Multiple File Selection 6.Curve Preview 7.Metadata Table 8.ADAMS .res 9.Bessel Filter 10.HG Trans GUI 11.IIHS Intrusion Templates 12.Python Function Interface 13.Context Menu for HG3D 14.Diadem XML 15.Build Plots Filter 16.dB10/dB20 Reference Value 17.Range-pair Function
	HyperMath	<ul style="list-style-type: none"> 1.Variable Browser 2.Auto-completion 3.Context Sensitive Help 4.Optimization Library 5.Variable Visibility 6.Debugger 7.Math Library 8.Utility Functions 9.Statistical Math Library Items 10.Language Items 11.HyperWorks Integration 12.User Interface 13.FFT Based Functions 14.Deprecated Functions
	Multiscale Designer	<p>Multiscale Designer is an efficient tool for development and simulation of multiscale material models of continuous, woven, and/or chopped fiber composites, honeycomb cores, reinforced concrete, soil, bones, and various other heterogeneous materials. Applications include multiscale material modeling for design, ultimate failure, statistic based material allowables, fatigue, fracture, impact, crash, environmental degradation, and multiphysics simulations and provides plugins to commercial FEA solvers Optistruct, RADIOSS, LS-DYNA, and Abaqus.</p>
	HyperCrash	<ul style="list-style-type: none"> 1. LS-DYNA Support 2. LS-DYNA Connections 3. Seatbelt Routing 4. Model Browser 5. LS-DYNA Transformation 6. RADIOSS Sub model 7. Element Quality 8. Selection By Ellipse/Circle 9. Group of //SUBMODEL 10. Multi-Files Import 11. Free-Hand Node Move 12. Display Graphic Objects 13. Seat Deformer with Tetra Elements 14. Unsupported Cards 15.Selection of Working Directory 16. LS-DYNA Connectivity Detection

		<p>17.Function in material 18.Node group in Rigid body 20.Dummy positioner 21.Mesh Display Control</p>
	<p>Solid Thinking Inspire</p>	<p>Capability to solve Topology, Topography, Gauge and Lattice Structure optimization by applying loads and supports directly on the geometry-surfaces / solids. Ability to create lattice structures inside the design space based on the target parameters. The lattice file should be able to be exported for further processing and printing. Ability to import the native CAD file formats - CATIA V4 &V5, UG NX, Inventor, Creo, SolidWorks, Pro/E, IGES, Parasolid, STEP, STL. Capability to apply loads & boundary conditions on the geometry in the form of forces, pressure, torques, gravity loads, acceleration loads, temperatures, displacement constraints, stress constraints, mass targets, frequency constraints. Capability to apply Component loads which are in the form of - Forces, torques, and g-Loads in terms of their x, y, z components. Design engineer should have an option to define either maximize stiffness or minimize mass as an objective function. Capability to solve Linear static, Modal and Buckling analysis. Capability to perform inertia relief to analyse unsupported systems that are not fully grounded. Typical applications are an airplane in flight, or a satellite in space. Capability to perform FEA on optimized concept of sheet metal/solid components/lattice structures. Contact Tools to find neighbouring parts and designate whether the type of contact to be bonded/contacting/have no contact. To be able to define contacts between surfaces or manually created between parts. Availability of Fastener and Joints tools to add bolts, screws, pins, or sliding pins. To be able to create grounded bolts, grounded screws, grounded pins and grounded sliding pins that can act as supports in load cases. Ability to create spot welds to connect surface parts together by welding them at specific locations. Ability to do Optimization using grounded fasteners or cylindrical supports. To be able to constrain the axial and shear forces using the optimization properties. To be able to enable connection stiffness for estimating the axial and shear stiffness for grounded joints/cylindrical supports. To be able to do Optimization based on Bolt Pretension applied at bolt locations. Joints tool to be available to identify and create hinge, cylindrical, translational, ball and socket, planar. *.FEM input file format should be generated for: a. Topology & Topography, Gauge b. FE analysis Capability to create final output files using PolyNURBS - Ready for 3d printing/Manufacturing. Capability to fit manually created PolyNURBS more closely to an optimized shape. Interactive Results Visualization of optimized shapes and ability to fine tune the weight of the results. Capability to call out and check Minimum and Maximum values of different parameters such as Displacement, Factor Of Safety, von Mises Stress etc after doing an FE Analysis of the original component or the optimized result. Bead pattern visualization to know the bead boundaries and widths. Capability to calculate and extract dynamic loads from Motion Analysis and the same to be made available for use in FE part analysis and part optimization automatically, in the form of discretized load cases. Capability to calculate and extract dynamic loads from transient analysis from motion analysis and the same to be made automatically available for simulation of a part in FE analysis and optimization runs, in the form of discretized load cases. Capability to define grounded components in the motion assembly. Capability to group parts that are rigidly attached to each other and move together in the motion assembly. Capability to automatically identify and create joints between moving parts of the motion assembly. Capability to create and define motors and actuators that drive the motion assembly. Capability to create and define Coil and Torsion Springs in the motion assembly. Capability to define dynamically changing motion-based contacts between parts in the motion assembly. User Interface</p>

		<p>Single graphical user interface (GUI) for Geometric modeling, topology optimization, topography, gauge, lattice, FEA, PolyNURBS/Polygonal modelling, Motion (kinematics), Manufacturing - Casting, Stamping feasibility.</p> <p>Tabular result options for multiple FEA/Topology optimization runs should be in same GUI.</p> <p>Automatic mid surface generation</p> <p>Availability of customizable materials database</p> <p>Support for Teamcenter Software.</p> <p>Partition tool to be available for dividing a part into design and non–design regions by selecting a hole, pocket, or face to offset.</p> <p>To be able to create 2.5D section to extract sketch curves from optimized results.</p> <p>To be able to run on Windows 10 x64 OS and above.</p> <p>Geometric Kernel</p> <p>Polygonal modeling capabilities - NURBS from polymesh data.</p> <p>Direct modeling capability-Sketch tools like lines,</p> <p>Geometry tools-mirroring, scaling, revolving, push/pull, tangency and perpendicularity.</p> <p>Geometry export capability - IGES, PARASOLID, STEP, STL.</p> <p>Part Instances capability</p> <p>Capability to move features on the part such as holes, pockets, ribs etc.</p> <p>Manufacturing & Shape Controls Capability</p> <p>Option to add single draw, split draw, extrusion, symmetry, cyclic symmetry constraints for Topology concept generation.</p> <p>Option to apply Bead pattern constraints to get better manufacturability in Topography concept generation.</p> <p>Option to add Overhang constraints for Additive Manufacturing feasibility and to reduce the need for support generation.</p> <p>Option to check the Stamping feasibility to check the thinning distribution and potential formability issues such as cracks and wrinkles.</p> <p>Should be able to run a casting feasibility analysis based on product geometry to check for potential areas of shrinkage porosity.</p>
	Inspire Cast	<p>Altair Inspire Cast is a fast, easy, accurate and affordable casting simulation environment focused on creating high quality components with increased profitability through a highly intuitive user experience. It is the only tool that caters to beginners and experts alike, from product designers to foundry engineers. Right from early design phase, users can visualize typical casting defects such as air entrapment, shrinkage porosity, cold shuts, mold degradation and rectify them avoiding costly downstream corrections. Guided process templates offer 5 easy steps to simulate Gravity Die, Gravity Sand, Investment, High Pressure, Low Pressure Die Casting and Tilt Pouring.</p>
	HyperForm	<p>Die Module</p> <ol style="list-style-type: none"> 1. New binder creation by extension of the part 2. Addendum creation supported with option to consider ribs at corner 3. Automatic calculation of offset based on thickness and offset value for punch and blank holder Creation. 4. Organize option under the User Process to consolidate part, addendum and binder to one Component to simplify Incremental setup. 5. Improvements in the double attach option 6. Drawbar creation for complex lines. <p>Incremental User-profile</p> <p>Incremental Solver</p> <ol style="list-style-type: none"> 1. Support for multi-stage processes to run in batch mode to leverage servers and clusters 2. Support of Datum, the reference object used for relative positioning of all other objects. 3. Performance of springback comparison tool significantly improved 4. Ability to pick material created in the session without storing in material database. <p>One-Step Solver</p> <ol style="list-style-type: none"> 1. Seamless integration with HyperStudy for blank size optimization (available on Windows platform) 2. Results Mapping 3. Fast (Fine Mesh) Option 4. Guide pins/Spacers/Pilots 5. User Process/Auto Process 6. Process Setup from Geometry <p>Forming module:</p> <ol style="list-style-type: none"> 1. Springback Setup 2. Cutting Angle Calculation 3. New Process Type 4. Unflange Tool

		<ol style="list-style-type: none">5. S-section Addendum Creation Panel6. Drawbead and Drawbar Creation Panel7. Stopper8. Tube HydroForming Setup9. Temperature Output in .sta Files10. Forming Contact TYPE 2111. Output Animation Files sensor12. Output Stresses
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