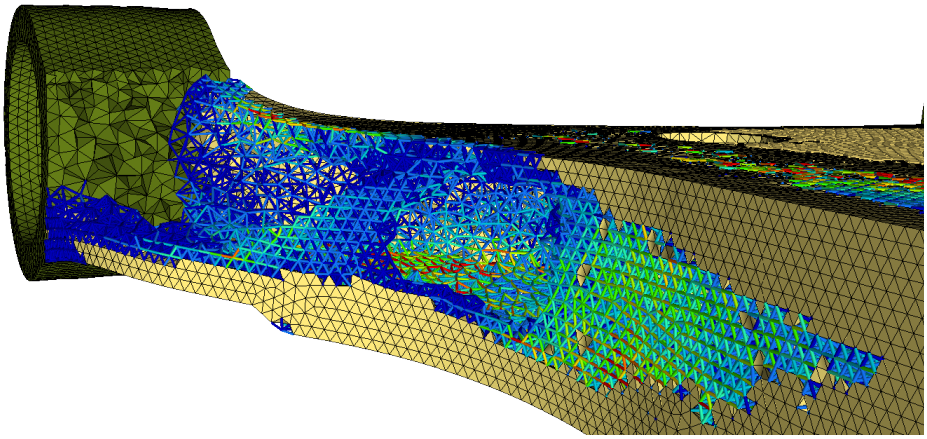
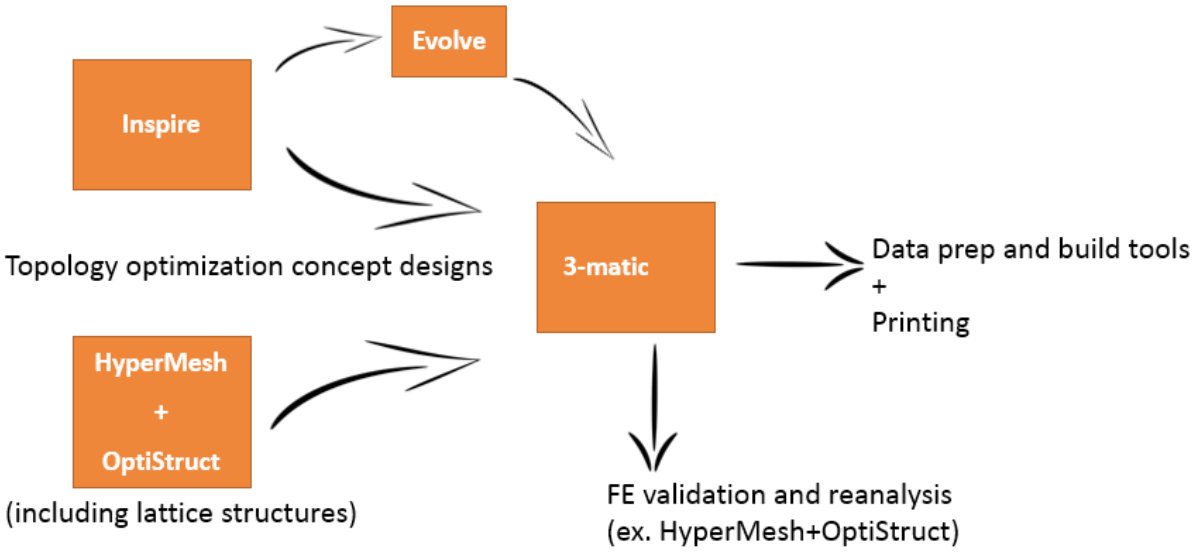
Engineering the Design Process for 3D Printing

While thinking about the theme of this month's article, I remembered the title of a famous book by Henry Petroski, "To Engineer is Human". Although the book covers many examples of engineering feats and lessons learned from spectacular failures that resulted from inadequate design, the title itself is thought provoking. We humans would like to engineer everything. Analyze, synthesize, optimize. One area that is gripping the engineering community with large mass appeal is 3D printing, or additive manufacturing. With a confluence of many factors like aggressive marketing, advancements in manufacturing processes, willingness and bold initiatives to reduce weight, the adoption phase has clearly crossed the chasm from early adopters to an early majority. Just look at a sample within the Altair resource library showing the mainstream markets adoption of 3D printing.



At the heart of 3D printing lies the design flexibility. No longer are there the constraints of traditional manufacturing processes that limit the design best suited for form to function. Topology optimization that generates material layout best suited for function is a perfect foil to seed the engineering element in the design process. Altair's OptiStruct has been a pioneer in producing innovate designs through topology and various optimization schemes for over 20 years. Earlier this year, an industry first solution of generating optimized lattice structures was made available in OptiStruct. As noted in the press release, prevailing technologies simply apply lattice structures to existing geometry, OptiStruct actually enables the designer to identify the best material placement and lattice structures. Optimization identifies where material is needed in a design and where it is not required, prior to placing and optimizing the lattice. There is engineering principle involved in generating a literally unrestricted geometry which can be manufactured with 3D printing.

Traditional topology concept designs, as well as optimized lattice structures, are brought into Materialise 3-matic, a product from the Altair Partner Alliance member Materialise. It is worthy to note that even with traditional topological geometries, Materialise 3-matic has capabilities to fill the volumes with lattice structures for further weight reduction benefit. Design operations on the optimized geometry like smoothing and editing the lattice structures to ensure buildability are performed in Materialise 3-matic. The updated design is then exported to data prep and build tools for printing or to FE validation and reanalysis with additional loadcases, back in OptiStruct for example. Optimized lattice structures from OptiStruct can be imported in the latest version of Materialise 3-matic (v11.1) that is now available to APA users. Additional documentation with tutorials can be found here.



Generating optimal designs for 3D printing through engineering principles is one of the significant milestones achieved. There are other areas that are being actively looked at and researched, like simulating the 3D printing process in predicting residual stresses and distortions to improve the part quality, or studying the mechanical characteristics of final part manufactured. Check out the trending topics on the Altair blog related to 3D printing, including an interesting article about The Future of 3D-Printed Fashion by Materialise. A technology demonstrator project involving Altair, voxeljet and two APA members (HBM nCode and Click2Cast) recently was exhibited in Hannover Messe showing 3D printing in innovative mold making process driven by simulation.

Questions or comments?
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To learn more about Materialise 3-matic, nCode DesignLife or Click2Cast, visit www.altairalliance.com.

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