# SIM20611 – We’re Having a Kegger! Upfront Simulation for Optimized Design

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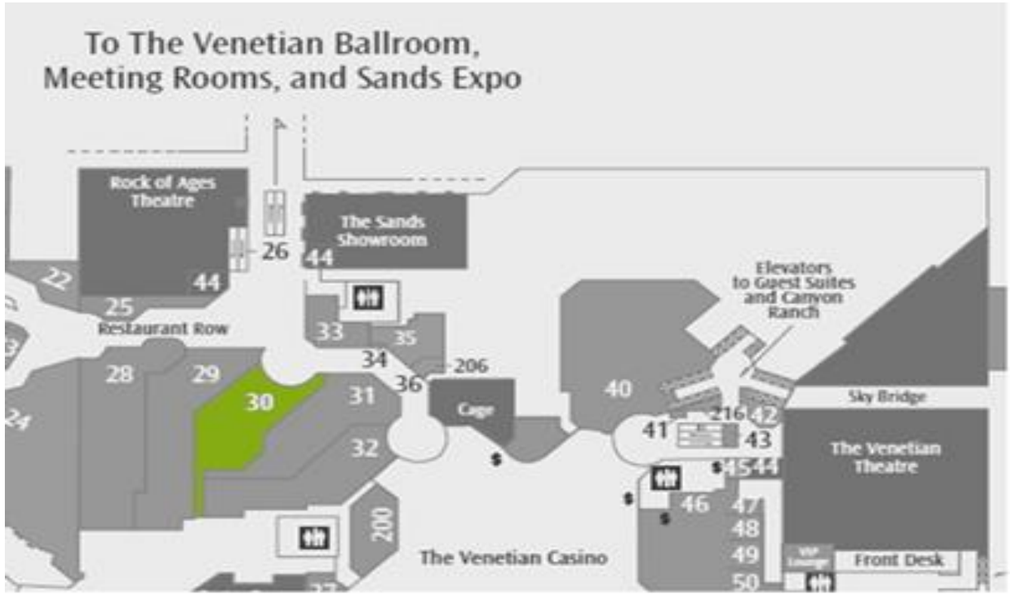
# Class summary

Implementing simulation into your design process early and often can help you to reduce physical prototypes as well as reduce the chance of unexpected product failure. In this class, we'll walk you through 6 analyses that could save you in the long run, with beer!

# Key learning objectives

At the end of this class, you will be able to:

- Simulate your designs using most of Fusion 360's analysis types
  - Linear Static Stress, Thermal, and more
- Drop test designs using Simulation Mechanical
- Run 2 different Moldflow products
  - Fill/Pack/Warp, optimized gate location, defect visualization
- Recreate the most complex CFD analysis type we have
- Understand which Simulation offering is right for your needs
- Go to the simulation social at the Public House



# While you enjoy a beer…

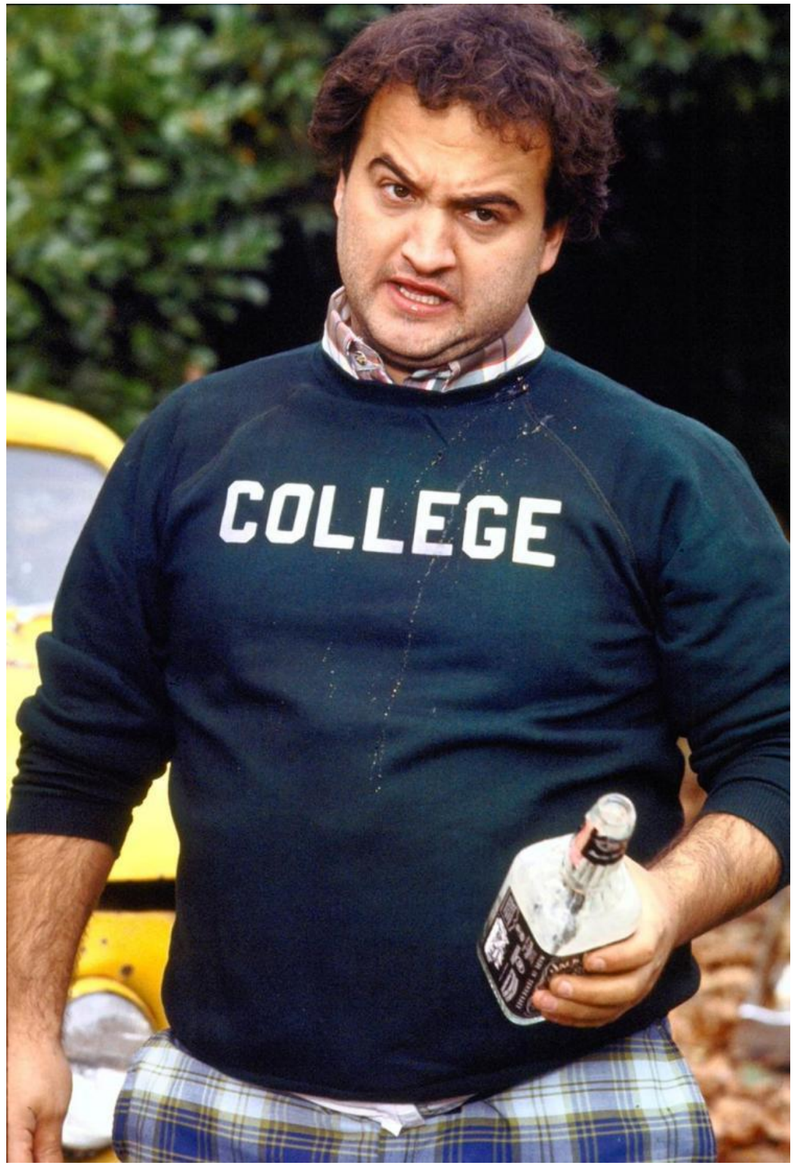
- Tweet at us!!!
  - @adskSimulation
  - @UnproEng

  - Picture of the class
  - Picture of you
  - Picture of me
  - Picture of anything!

- Ask some questions along the way.

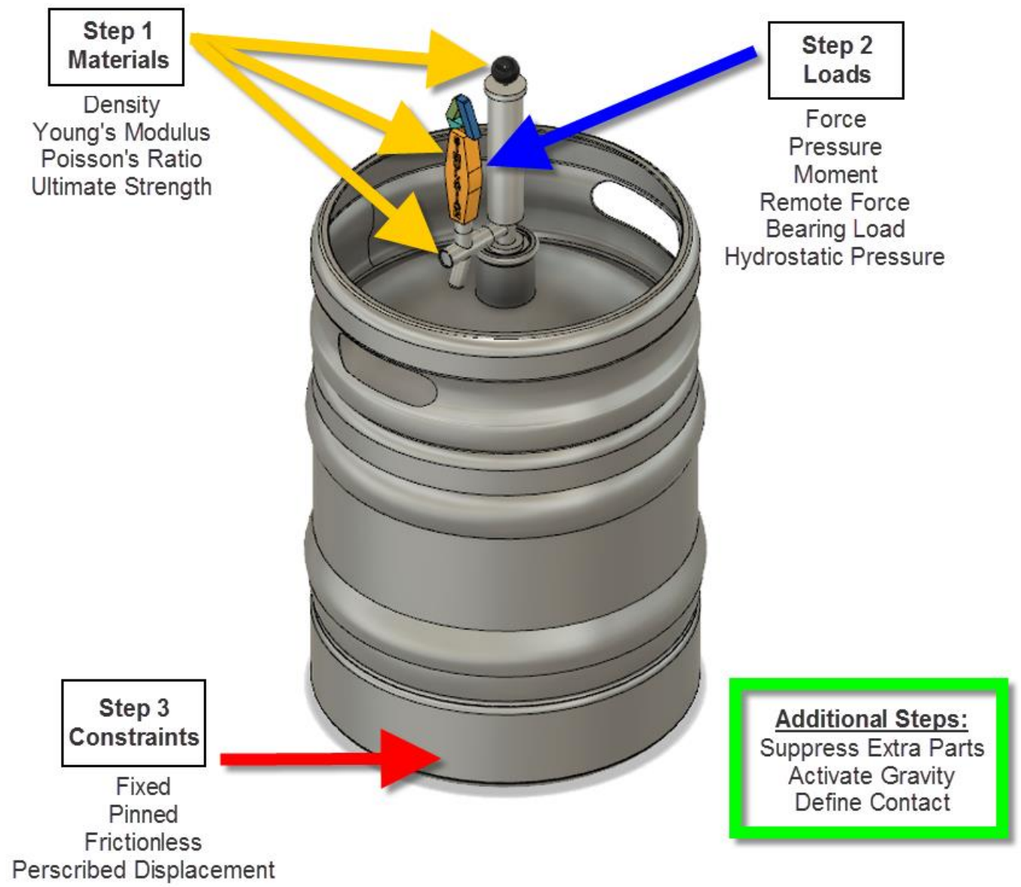
- Think how this ties back to your design.

- Sit back and enjoy!



# Linear Static Stress Analysis

## LSS Quick Setup Reference




***Fun Fact!*** Define your parts properties in the Design environment and their colors will transfer to the simulation environment.

## What product is right for me?

CAD agnostic, stand alone product, CFD interoperability, more advanced simulation options than Inventor Simulation

Integrated with Inventor and SolidWorks, frame generator interoperability, more advanced simulation options than Inventor Simulation

An environment inside of Inventor, easy to use designer level tool for upfront analysis work

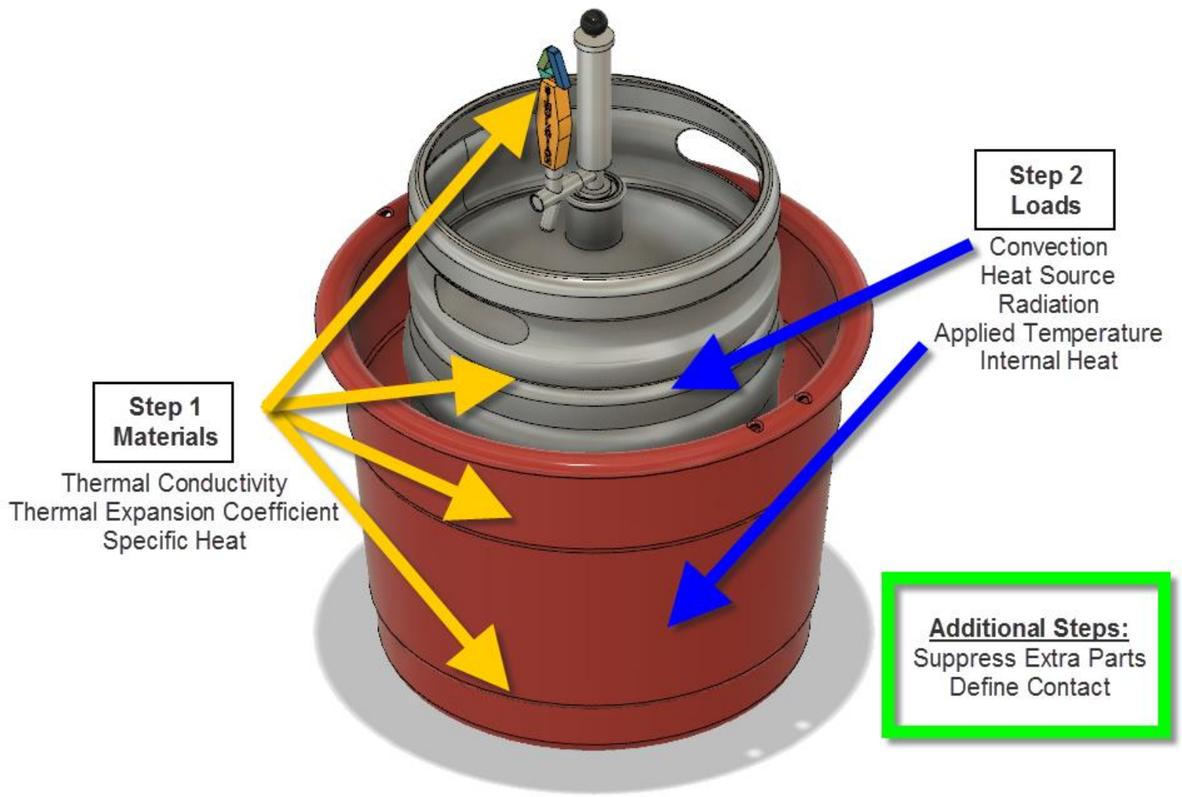
Easily share results for review via A360, simple part/assembly meshing, it's the future of Simulation so why not start doing your work here?

## Fusion 360 pro tips:

- It is recommended to have at least 3 elements through the thickness of any part that the results matter.
- Garbage in / garbage out – make sure to include anything that makes your analysis real world, such as surface to surface contact, gravity and accurate materials.
- Ensure your mesh is not creating "hot spots" and leading you to erroneous conclusions. If your stress is going past yield, you will have to run a nonlinear materials analysis.

# Heat Transfer Analysis

## Thermal Quick Setup Reference




***Fun Fact!*** If you're having trouble & need help, Screencast can be launched inside of Fusion 360 to record your problem for support.

## What product is right for me?

CAD agnostic, stand alone product, apply results to other analyses, more advanced simulation options than Fusion, transient heat transfer available

Integrated with Inventor and SolidWorks, more advanced simulation options than Fusion

CAD agnostic, stand alone product, couple thermal results with fluid flow, export results to Simulation Mechanical for stress results, transient heat transfer available

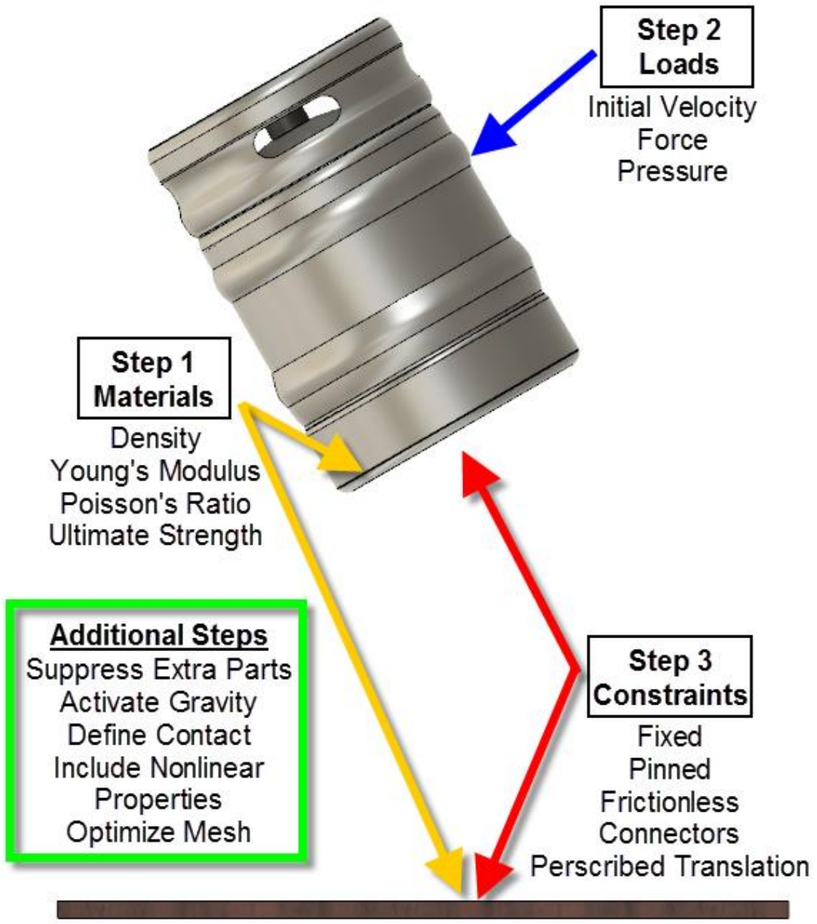
Easily share results for review via A360, one simple workflow in the design process, it's the future of Simulation so why not start doing your work here?

## Fusion 360 pro tips:

- Thermal in Fusion 360 is currently a steady-state analysis, not taking change over time into account.
- After defining contact between parts, you can enter the contact definition screen to define a thermal resistance value (ie – an epoxy holding parts together)
- You can use the DOF view to determine if your parts are conducting or insulated. This tells you if each part is connected properly as well.

# Event Simulation Analysis

## Event Sim Quick Setup Reference




***Fun Fact!*** Both the Moldflow material library and Moldflow fiber orientation results can be loaded into Simulation Mechanical.

## What product is right for me?

CAD agnostic, stand alone product, works well with larger models, analyzes longer run durations (such as seeing bounce), more material models then Fusion 360,

Integrated with Inventor and SolidWorks, advanced contact settings and more material models than Fusion 360, you can say that you use Nastran, just like NASA!

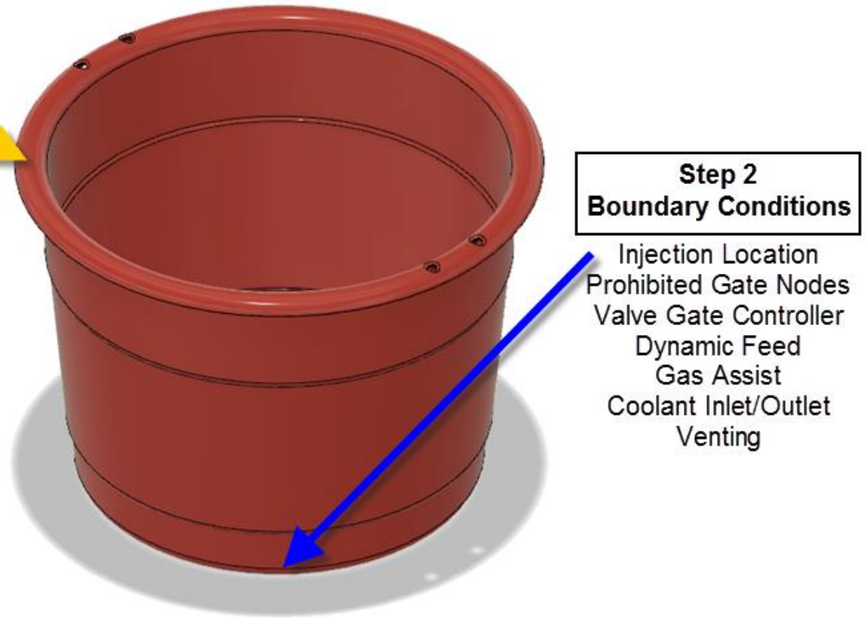
Integrated into the Fusion design environment, runs better on smaller models, made for short run durations (where part velocity is calculated and model is just mm from impact), predicts material failure with element deletion

## Simulation Mechanical pro tips:

- Using an impact plane instead of modeling a floor is a great way to save in element, contact elements and reduce solve time.
- It is more important to reduce parts and elements in event simulation than any other analysis. Eliminate unnecessary parts, use local mesh refinement in points of interest and a larger global mesh size when possible.
- When performing a drop/impact test, move your model as close to the part that it is going to impact and apply the corresponding initial velocity based on height it is dropping from.

# Fill/Pack/Warp Analysis

## F/P/W Quick Setup Reference




***Fun Fact!*** Moldflow offers nearly 10,000 material in the library.

## What product is right for me?

Moldflow Insight – Enhanced process settings, additional advanced analysis types, API functionality, complete user mesh control, mesh repair tools

Moldflow Adviser – More advanced than Moldflow Design, easier to use than Insight but with less analysis types, reduced user control, no mesh repair tools

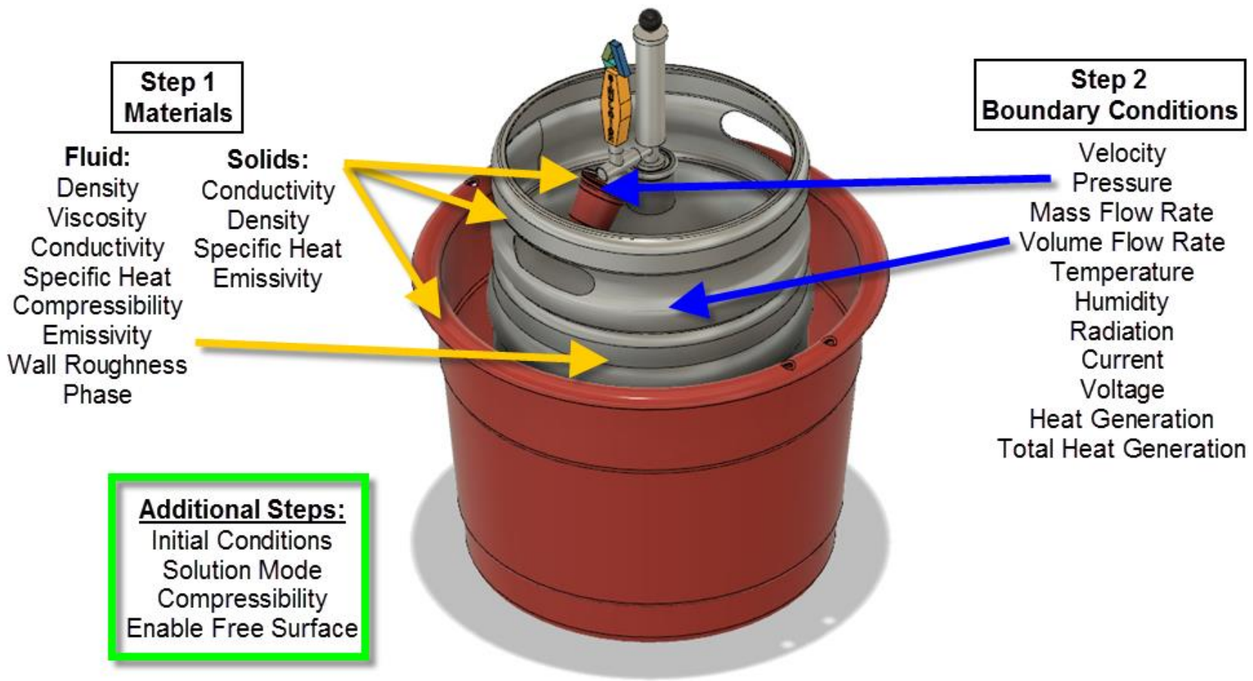
Early designer level use while creating product, visualization enhancement, weld line / weak point prediction, embedded in Inventor, SolidWorks and Pro/E

## Moldflow pro tips:

- It is recommended to have 6-8 layers of elements for a non-fiber filled material and 10-12 for fiber filled. The new mesher default is 10.
- Use CADdoctor, SimStudio Tools or Fusion 360 to simplify your model before importing. This will reduce element count and save analysis time.
- Place your injection cone on the CAD geometry before pressing mesh. This ensures that you have accurate placement without manually manipulating the mesh later on. The mesher also ads additional refinement in this area.

# Open Channel Flow Analysis

## CFD Quick Setup Reference




***Fun Fact!*** CFD Results can be exported to Showcase or VRED for amazing rendered imagery!

## What product is right for me?

Currently the only Autodesk fluid flow solution, fluid flow, thermal, coupled fluid thermal, free surface, export results to Simulation Mechanical for stress results

Thermal analysis only, can import pressure and thermal results from Autodesk CFD for stress calculations

Thermal analysis only

Thermal analysis only

## CFD pro tips:

- CFD requires a high mesh density to capture accurate flow, especially free surface analyses. Divide parts in CAD to increase mesh density where it is most important.
- Suppress all unneeded parts to save on run time. The best part is, they can be added back in the results for better visuals!
- All enclosed spaces will automatically create geometry to fill them when imported into CFD. You can also make an external fluid surrounding your part that automatically creates a part cavity in CFD. It can be a pain in CAD.

# Next Steps

- Go to the class downloads section and download the handouts and videos
- Follow Simulation and me on Twitter
  - @adsksimulation
  - @UnproEng
- Rate this class and the presenter, preferably with **10s**!
- Email me any additional questions you come up with
  - James.Herzing@Autodesk.com
- Go to the social at Public House