FEA Notes

1. **Plan your design and analysis approach before you start your CAD drawings.** The features in a CAD drawing can usually be created in a number of ways. Plan how you are going to create them so that you can accommodate doing analysis without drawing the part twice, once for manufacturing and once for analysis. Plan in advance where you should stop with the CAD work to do preliminary analysis. A lot of time can be wasted by getting too far into the design before doing a reality check with analysis.

2. **Calculate approximate results before creating the CAD model and doing the first analysis.** Use analytic techniques to compute approximate stresses prior to running the first analysis. You may have to use greatly simplified geometry for this first cut at the analysis, but it should give you an approximate answer. If the FEA produces results greatly different than the analytic technique you must investigate the problem and determine the reason for the differences. Frequently a significant difference in the solution points to an error in one or both of the solutions.

3. **Reduce the CAD model to the minimum required detail.** CAD models are usually very complex and many of the details are not necessary for finite element analysis. Suppress this information before doing the analysis. If you are concerned about some of the material you suppressed, you can always bring it back into the model and do a more detailed analysis. Start with the simplest analysis you can do. If it shows the stresses or deflections to be too high you need to redesign the part and if it shows the part to be basically under stressed, a more detailed analysis may not be needed.

4. **Think about all the environmental conditions that could affect the design.** Structural and mechanical stresses are not the only cause of product failure. Consider motion, heat transfer, fluid flow, etc. FEA can be used to analyze more than stresses. Frequently the same model can be used for different types of analysis.

5. **Build and simulate complex conditions in steps.** Before starting the analysis, break the system into a series of models with increasing complexity. Make sure you completely understand each model and the results the analysis before moving on to a more complex model. Prove to yourself that the design is adequate with simple models before moving on to more complex ones. The simple models may be sufficient for the design process.

6. **Double check material properties.** Loads and constraints are important but materials are crucial to a model's accuracy. You can check the properties for many materials at www.matweb.com. Be sure to check the material properties at the temperature the parts will be operating.

7. **Consider a range of loads and constraints instead of just one.** Most design objects are required to function in a complex environment. Using just one load case may not be sufficient to fully explore the design's suitability in this environment. Try a range of loads from a range of directions to see how the design object responds.

8. **Conduct a full peer review.** Have members of your team or group look carefully at your results before accepting their validity. The reviewer should not only look at the correctness of the analysis but should also look to see if the analysis approach is valid and if more analysis is needed.