

NON-LINEAR ANALYSIS OF AIR VALVE

Company Background:

The essence of CSM's engineering services lies in our engineering expertise, quality processes and our domain expertise. This enables our customers to meet tight design schedules and cut costs in an aggressively competitive world. CSM stands ready to assist by sharing its experience in the field of CAD/CAM, CAE (FEA, CFD) & PDM, and to support the design activities. Our experience ranges across various domains such as automotive, aerospace, and heavy-engineering.

Project Objective:

The air metering valve is a integral part of the air management system for the diesel engine applications. The objective of the project is to determine the stresses due to contact while the throttle shaft assembly is subjected to an operating torque specified by the client.

Analysis/Solution Procedure adopted:

Analysis is performed in two load cases. In the first load case, the model is subjected to a specified operating temperature. In the second load case, the model is subjected to a pressure in ten increments, calculated w.r.t the torque supplied by the client. Pressure is applied directly at the base of the throttle shaft. A contact tolerance is provided between the tongue shaft and the driver shaft as per the drawing specifications. Nodes at ball bearing and needle bearing locations are transformed to cylindrical coordinate system. Coordinate systems are created separately at ball bearing and needle bearing locations. Ball Bearing and needle bearing are modeled by providing suitable bearing constraints. The pressure applied at the bottom of the throttle shaft make the tongue shaft rotate due to which the tongue shaft and driver shaft come into contact. The contact stresses and displacements are observed.

Challenges Faced:

Important challenge that was faced in this project was in deciding the way in which bearing constraints had to be defined. Initially, rigid elements were used to transfer the torque where the behavior was way off from expected. In order to avoid rigid elements, a local cylindrical system had to be defined and loads and boundary conditions had to be assigned to this system.

Software used:

Pre and post processor: MSC MENTAT

Solver: MSC MARC

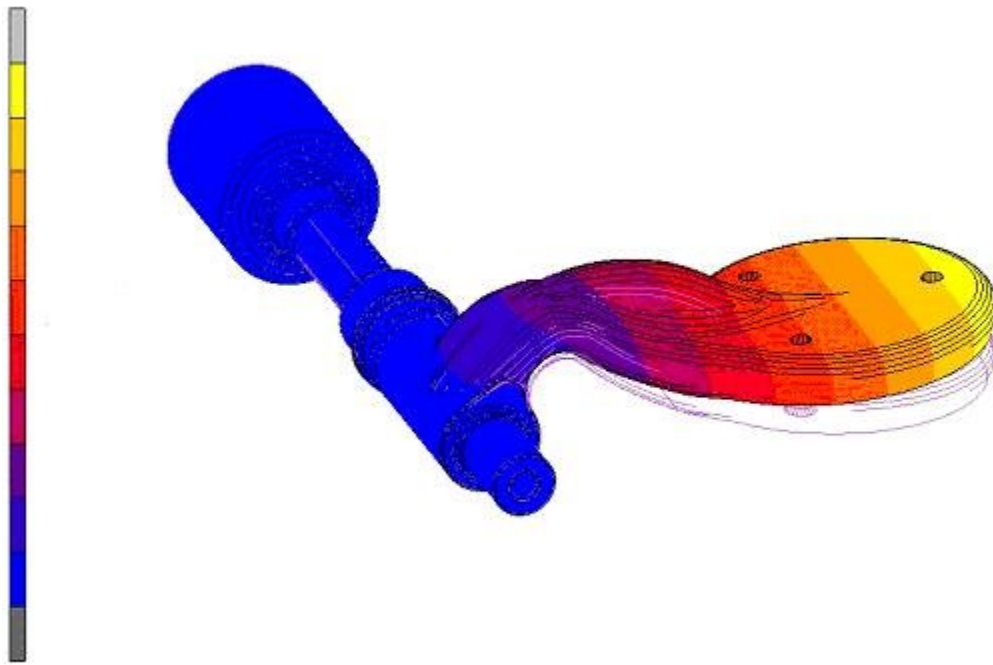
CSM- a vendor of choice:

Various projects are executed in the non-linear analysis domain exploring all the suitable options for the nature of the problem. Vendor is given a choice to adopt any of the various options suggested according to their mode of operation and requirement. The design modifications after reviewing the results are aptly suggested to enable optimum utilization and increase the life of the structure. Changes suggested by the client in the design stage (modification in the scope of work after reviewing the results) are incorporated and the analysis is further modified and reviewed.

Value additions to the client:

Clients, having the simulation in hand, will have the liberty to make various trials and choose an optimum design for implementation. This provides cost saving and material optimization.

Pictures/graphs:



Displacement plot of the assembly