

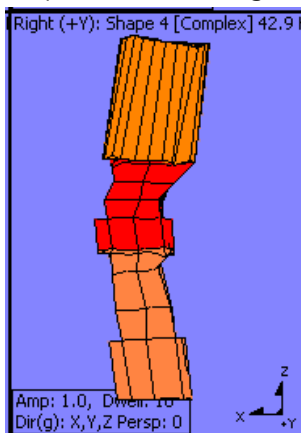
**An Investigation of Johnston Vertical Pump Vibration Problem, 2005**

The reliability of the Johnston vertical pump was investigated. Based on the Modal analysis performed and Finite Element Analysis, it is concluded that the root cause of the Johnston Vertical Pump problem is a structural resonance problem.

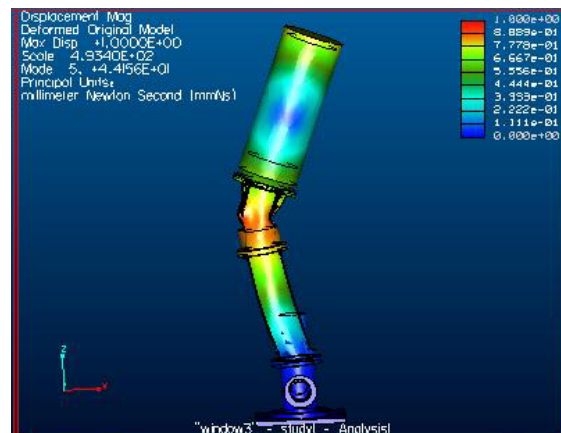
From Modal analysis and FEA, the vertical pump was having its 2<sup>nd</sup> bending mode (X-direction) at 52Hz; close to the running speed of 50 Hz, hence, nearly hitting its structural resonance. The ODS animation clearly showed that the structural movements by this 2<sup>nd</sup> bending mode was dominating and having its anti-node at the thrust pot – discharge head interface assembly that would eventually caused the mechanical seal and other related components to wear. This explains the low reliability of this Johnston Vertical pump.

Based from the analyses results, the dynamic design criterion was established as follows; a dynamic design criterion was established that would shift the 2<sup>nd</sup> bending mode in X-direction of Vertical Pump away from the running speed while ensuring that the 2<sup>nd</sup> Bending Mode in Y-direction will not enter into the Pump operating region.

Therefore, the modification is aimed to stiffen the thrust pot – discharge head support structure. Structural Dynamic Modification (SDM) was performed by introducing stiffener to the existing thrust pot and discharge head.



Mode shapes @ 52.0Hz (2<sup>nd</sup> Bending X-direction)



FEA Mode shape@ 44.2Hz (X-direction)