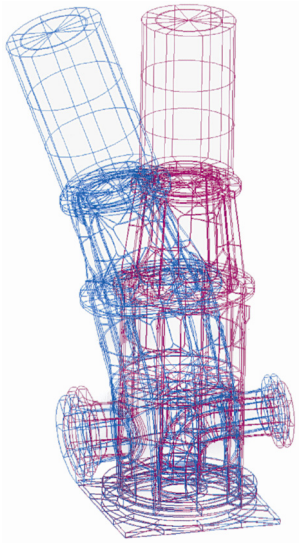
# MODAL ANALYSIS OF GASOLINE BOOSTER PUMP

During any engineering project unforeseen difficulties can arise which seriously threaten commercial and/or engineering success. In the majority of cases such problems can be resolved by members of the project team, however, in some circumstances the use of outside assistance is deemed to be beneficial, either because the nature of the problem is beyond readily available expertise or because it is felt that an impartial view is required to achieve a timely solution to the problem.

In one such example, FCL were called upon to assist with an operational problem found during commissioning trials of a refinery gasoline booster pump. The problem manifested itself as an excessive vibration of the above-ground structures at the normal running speed of the pump and represented a serious threat to timely start-up of the refinery.



It was clear at the outset that the cause of the vibration was resonance between the structure and the pump rotor and that the logical course of action would be to modify the natural frequency of the pump so as to remove it from the pump rotor frequency. Time pressures dictated that the solution put forward be *'right first time'* without the need for any further work and/or modifications. FCL began their work with a series of modal analyses using finite element techniques, firstly to replicate site natural frequency measurements and then to investigate the feasibility of adjusting the mass and/or stiffness of the structure to achieve the desired shift in natural frequency. Having developed and ranked a number of alternatives, a design modification was agreed which involved cutting two additional rectangular openings in the pump support stool to reduce the stiffness of the structure thereby reducing its natural frequency. Finally, to provide further confidence in the chosen design scheme a number of additional analyses were performed to examine the sensitivity of the modified natural frequency to changes in the foundation stiffness and the total pump mass. The wisdom of employing FCL to tackle this problem was proven by further commissioning trials during which pump vibration was reduced to insignificant levels.

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