NON-LINEAR STRUCTURAL ANALYSIS OF COLD MASS SUPPORT STRUCTURE OF THE STEADY STATE SUPERCONDUCTING TOKAMAK SST-1.

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The SST-1 is a steady state super conducting tokamak, which is in the final phase of commissioning tests. The super conducting magnet system of SST-1 comprises of Toroidal field (TF) and Poloidal field (PF) coils. The 16 TF coils are nosed and clamped towards the in-board side and are supported toroidally with inter-coil structure at the out-board side, forming a rigid body system. The 9 PF coils are clamped on the TF coils structure. The integrated system of TF coils & PF coils forms the cold mass of @ 50 Ton weight. This cold mass is accommodated inside the cryostat and freely supported on the 16 cantilevers welded to the toroidal rigid support ring at 16 locations and support ring in-turn supported on 8 columns of machine support structure. During the operation this cold mass attains a cryogenic temperature of 4.2K in the hostile environment of high vacuum$1x10^{-5}$ mbar. The thermal excursion of cold mass and its supporting structure during this cool down results into severe frictional forces at the supporting surfaces. In this paper, we discuss the effect of coefficient of friction (μ) on von-Mises stresses in cold mass support structure of SST-1 machine and need for lubrication, by performing non-linear (contact) structural analysis, using Finite element analysis code ANSYS. We estimate the maximum stresses in the structure for various coefficients of friction and compare them with analytical values. Analysis results shows that there is a design requirement of introducing a thin layer of solid lubricant film of MOS2 having coefficient of friction 0.05 between the sliding surfaces to control the stress contribution due to the friction.