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Wed-Af-Po3.17-09 [37]: Analysis of the mechanical behavior of the KSTAR CS magnet during long pulse plasma discharges

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The KSTAR central solenoid (CS) is a vertical stack of four pairs of coils compressed axially by preloading structures. The axial compression on the CS coils is monitored by measurements of strain and displacement, which are important monitoring parameters for safe operation of KSTAR. The equivalent vertical force methodology of a simplified multi-spring system was developed to analyze the preload and displacement variations of the CS magnet. The equivalent vertical force is based on the poloidal field (PF) coils and plasma currents during plasma discharge. The estimated vertical displacements by the developed method were reasonably well in agreement with the displacement measured during long pulse discharges in 2017 (#18437) and 2018 (#21735) campaigns. The analyzed displacement can be used to quickly calculate the preload reduction of the CS magnet structure. This approach contributes to the development of advanced operation scenarios for long pulse and large plasma current discharges with safety margin. During plasma discharge, this algorithm can be applied to a real-time plasma control system.

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