Ultra Large-Scale Nonlinear FE Analysis of Welding Mechanics

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Abstract: Large-scale thin-plate structures including ships are constructed by welding, and distortion can occur after welding. Welding deformation can increase cost and work time, and so it is important to investigate welding deformation before construction. In this research, to predict welding deformation on the construction of a large thin-plate structure, Idealized Explicit FEM (IEFEM) was applied to the analysis of welding deformation on the construction of a ship hull block. In addition, to efficiently analyze deformation of the whole structure of a large-scale structure, an algebraic multigrid (AMG) method was introduced into the IEFEM. Then, this multigrid IEFEM (MGIEFEM) was applied to the analysis of welding deformation on the construction of a ship hull block. The ship hull block consisted of 10 million degrees of freedom and the MGIEFEM analysis was finished within the practical computing time of a week. Thus, it can be said that MGIEFEM is an effective tool for analyzing the welding deformation of real products.