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Numerical simulation of welding distortion in thin plates from austenitic stainless steels and application of thermal method for control of distortion

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After completion of welding, tensile residual stresses near the weld zone develop to balance with compressive residual stresses away from weld zone. For the plate thinner than 4 mm, this fact and low stiffness of material causes buckling distortion. In the austenitic stainless steels due to lack of phase transformation, shortening in the welding zone is more than structural steels. This shortening causes more tensile stresses and more deformation after welding. On the other hand thin plates from stainless steels widely use in different branch of industrial. For control and minimization of buckling distortion a lot of experimental efforts should be used and some methods should be applied in the manufacturing of equipment on which thin plates are used. Thermal tensioning method is in the base of heating of base metal during welding in very sensitive time, temperature and width of heating. Application of this method in welding of thin plates is very suitable. The compare of another methods, this method is very economic. In this technique, heating produces tensile stresses in direction parallel to seam. So metal undergo to welding expands more freely. Tensioning of metal during welding, final length of plate in direction of welding is more than typical welding. So tensile residual stresses and also corresponding deformation will be decreased. On the other hand control of different parameters of this method is very difficult. For example, temperature and time of heating is very critical parameters in this method. Heating in more than allowable temperature causes plastic deformation in the zone of heating. Experimental tests always very expensive specially in austenitic stainless steels. On the other hand with change in the relation between length and width of plate, adjustment parameters of this method should be changed. in two past decades computational methods for simulation of welding were developed. Finite element method is very powerful method for simulation of welding processes. Numerical modeling of welding in thin plates can predict final deformation of plate after completion of welding and cooling. On the other hand different parameters of thermal tensioning method, may be change very easily for minimization of less deformation after welding. in this research for confidence of numerical model at the first step with use of SYSWELD program, final deformation of plate with 1mm thickness was simulated and angular distortion and longitudinal bending were compared with experimental test. At the second step with adjusting of parameters of thermal tensioning method for numerical simulation, final deformation and residual stresses were decreased.