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Assessment of mechanical properties of austenitic stainless steels using artificial neural networks

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Abstract

Knowledge of material properties is of key importance when planning the production of a product. This also applies to steel structures. Therefore, for the correct planning of a certain steel part or the production of a structure, it is necessary to get acquainted with the properties of the material, in order to make the correct decision about which material should be used. Bearing in mind that the volume of production of steel products is constantly increasing in various branches of industry and engineering, the problem of predicting the material properties needed to meet the requirements for efficient and reliable functioning of a certain part becomes imperative in the design process. In this research, a method for predicting four material characteristics (yield stress, tensile strength, elongation and hardness) for two stainless steels, using an artificial neural network (ANN), is presented.

These material properties were predicted based on the known chemical compositions of the analyzed steels and the corresponding material properties available in the Cambridge Educational System EDU PACK 2010 software, using the neural network module of the MathWorks Matlab software package. The method was verified by comparing the material property values predicted by this method with the known property values for two analyzed stainless steels: X5CrNi18-10 (AISI 304) and X5CrNiMo17-12-2 (AISI 316). The difference between the two sets of values was less than 5% and in some cases even negligible, which indicates the possibilities for the application of new technologies for predicting material properties.

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