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Theoretical method for prediction of press-mounting force and stress distribution in assembly process of interference fits

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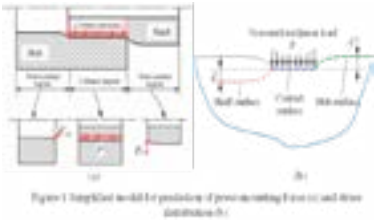
Statement of the Problem: Interference fit is widely used in many industrial fields for its high ability to transmit an axial force or torque between a shaft and hub. Thick-walled cylinder theory (TCT) is the main tool for analysis and design of interference fit. After many researches, theoretical methods based on TCT were more abundant and perfect, which can be adopted for complex structures and different operating conditions. However, the current theoretical system still has some shortcomings, such as the influence of non-contact regions on stress distribution and press-mounting force. Since the stress distribution and press-mounting force in the assembly process are significant for analysis of contact surface wear and assembly quality estimation, the purpose of this study is to build a new theoretical model to predict the stress distribution and press-mounting force.

Methodology: A simplified model was proposed by dividing the geometric model into three parts: contact region, non-contact regions of shaft and hub respectively. Then, the press-mounting force was calculated by the combination of the friction force generated by contact region and a resistant force generated by non-contact regions. The stress distribution equation was also deduced based on a simplified model that a non-uniform linear load acts on a portion of the semi-infinite plane.

Results: The theoretical results of press-mounting force were consistent with simulation results and validated by experiments. The prediction results of stress distribution were also compared with simulation results which indicate that the new theoretical model has high accuracy in stress distribution prediction.

Conclusion & Significance: The new theoretical model can give more accurate and reasonable results and provide a more reliable approach for designing of interference fits. Furthermore, this model also provides a method for improvement of the analytical method of interference fits under different structures and operating conditions.



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4. You B, Luo Y and Wang X D (2014) The application of computing methods for analysis of press-fit assembly in elasto-plastic field. Journal of Information & Computer Science 11(9):3157-3166.

Biography

Xingyuan Wang is major in precision instruments and machinery. He is devoted to the assembly of small precision interference fitting parts and assembly quality estimation. His theoretical model for prediction of press-mounting force and stress distribution based on thick-walled cylinder theory provides a standard for quality estimation.

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