Reliability-based design optimization of shank chisel plough using optimum safety factor strategy

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Résumé en anglais	Reliability integration into tillage machine design process is a new strategy to overcome the drawbacks of classical design approaches and to achieve designs with a required reliability level. Furthermore, design optimization of soil tillage equipments under uncertainty seeks to design structures which should be both economic and reliable. The originality of this research is to develop an efficient methodology that controls the reliability levels for complex statistical distribution cases of random tillage forces. This developed strategy is based on design sensitivity concepts in order to determine the influence of each random parameter. The application of this method consists in taking into account the uncertainties on the soil tillage forces. The tillage forces are calculated in accordance with analytical model of McKyes and Ali with some modifications to include the effect of both soil–metal adhesion and tool speed. The different developments and applications show the importance of the developed method to improve the performance of the soil tillage equipments considering both random geometry and loading parameters. The developed method so-called OSF (Optimum Safety Factor) can satisfy a required reliability level without additional computing time relative to the deterministic design optimization study. Since the agricultural equipment parameters are extremely nonlinear, we extended the OSF approach to several nonlinear probabilistic distributions such as lognormal, uniform, Weibull and Gumbel probabilistic distribution laws.
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