Golf Clubhead Optimization Based on Contribution of Eigenmodes

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Abstract

This study is aimed to optimize a golf club head for these purposes: to maximize the driving distance, to increase the sweet spot and to minimize the dispersion distance. One difficulty for this optimization is that the sensitivity function can not be derived analytically in impact problem, and then the sensitivity-based approaches can not be applied. Another difficulty is that the design variables are mixed, non-parametric and parametric variables. As a attempt to avoid these difficulties, the authors developed a optimization system by using basis vector method. The relation between the eigen frequencies and the coefficient of restitution is examined with FEM models numerically at first. It is found that there is a strong correlation between the first eigen frequency and the restitution performance in the impact problem. However, as the number of dimension increases, the contribution rate of the first eigen frequency decreases. It is necessary to take higher order eigen frequencies into account. Based on the obtained relation, the authors proposed an approach to created the basis vectors using the sensitivity functions of eigen values. The sweet area and the dispersion of the ball are also taken into account. Computational results are presented for demonstrating the effectiveness of the proposed approach.

Keywords: Optimal design, Golf club head, Impact problem, FEM analysis. Eigen frequency