

OPTIMAL MULTIOBJECTIVE DESIGN OF A HEAD PROTECTION HELMET: A LIMITING PERFORMANCE ANALYSIS

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Abstract: In this paper the limiting performance analysis of a head protection helmet is performed. A discrete model of the human head is used. A multiobjective optimum design problem is formulated in order to minimize the risk of injuries in case of impact. Several injury criteria are minimized and are required to remain below a safety threshold value. The optimal control force acting on the head is found. The optimal control force is determined by the Direct MultiSearch (DMS) derivative-free algorithm. The equations of motion are integrated at-once, as it is typical for static response, instead of the traditional step-by-step integration. This fashion, displacement, velocity and acceleration conditions can be imposed easily at any point in time.