NAFEMS UK Regional Conference 2018 - Abstract Submission

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Please identify the event for which your submitting?	NAFEMS UK Conference 2018
Will you be the presenting author?	Yes
Presentation Title	NUMERICAL MODELING OF STRACUTRAL VIBRATION RESPONSE OF ROCKFALL CATCH FENCES UNDER IMPACT LOADING CONDITIONS
Relevant Themes / Keywords	Structural mechanics (Multibody simulation), Verification & Validation (Simulation and testing)

Abstract (plain text)	Rockfall catch fences are flexible mechanical structures that used on hillsides to protect nearby infrastructures from being damaged by detaching falling rocks. Catch fences consist of wire mesh, posts, wire ropes, and ground anchors. They intercept and capture falling rocks by dissipating their kinetic energy mainly through elasto-plastic deformation of their components. Catch fences need to be continually inspected to ensure they are fully functional and to remove any obstacles due to minor impacts. Physical inspections are expensive and time consuming procedures. An alternative solution is to use acceleration sensors to monitor the structural vibration response of the catch fences and to detect any significant rockfall impact. However, the wide range of possible impact scenarios makes it difficult to distinguish between significant and non-significant impacts. Furthermore, geometrical variations in the design of the catch fences cause variation in the structural response that might lead to false detections. It is important to understand the structural vibration response of various catch fence designs in order to recognise significant impacts and to avoid false warnings. In this study, a numerical model of the catch fence was developed to calculate the structural vibration response under impact loading conditions. The model can accommodate a wide range of catch fence designs, including arbitrary separation between the posts. Finite element explicit calculation scheme in Abaqus software was used to calculate the acceleration responses at the top of the posts under various impact scenarios. The response was recorded at every time increment of the explicit solver in order to include the highest possible frequency response. As the explicit dynamic analysis of elasto-plastic impact behaviour is vulnerable to noise corruption at high frequencies. Digital signal processing (DSP) was used to remove this effect. Model calculations were validated against experimental results of full-scale impact tests on a catch fence. It was found that the predict structural vibration response can help to select the characteristic parameters of the sensor such as the sensitivity and the measuring thresholds that are required to detect significant impacts on the catch fences. In addition, the model can be used to optimise the distance between the sensors along the catch fences for each design arrangement in order to achieve an effective monitoring of the structural vibration response.
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