AN EXPLICIT SOLUTION OF THE PERFORMANCE OF A NEW BRAKE RING-TYPE ENERGY DISSIPATOR

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Abstract. The aim of this presentation is to determine the performance of a new brake ring-type energy dissipator used as a system's component of rockfall barriers and fences by the finite element method (FEM). The bearing ropes are guided through pipes bent into double-loops and held by compression sleeves. These ones works as brake rings. In larger events the brake rings contract and so dissipate residual energy out of the ring net, without damaging the ropes. The rope's breaking load is not diminished by activation of the brake. The resolution of this problem implies the simultaneous study of three non-linearities: material nonlinearity (plastic behavior), large displacements (geometric non-linearity) and friction-contact phenomena among brake ring components.

The explicit dynamic analysis procedure is carried out by means of the implementation of an explicit integration rule together with the use of diagonal element mass matrices. The equations of motion for the brake ring are integrated using the explicit central difference integration rule.

The presence of the contact phenomenon implies the existence of inequality constraints. The conditions for normal contact are $\lambda \geq 0$, $g \geq 0$ and $g\lambda = 0$, where λ is the normal traction component and g is the gap function for the contact surface pair. To include frictional conditions, let us assume that Coulomb's law of friction holds pointwise on the different contact surfaces, being μ the dynamic coefficient of friction. Next, we define the non-dimensional variable τ by means of the expression $\tau = t/\mu\lambda$, where $\mu\lambda$ is the frictional resistance and t is the tangential traction component. With these previous definitions, Coulomb's law of friction states that $|\tau| \leq 1$. Finally, conclusions of this study are exposed.