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FE assessment of dissipative devices for the blast mitigation of glazing façades supported by prestressed cables

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Abstract. The paper focuses on the dynamic response of a blast-invested glass-steel curtain wall supported by single-way pretensioned cables. In order to mitigate the critical components of the façade from severe structural damage, an innovative system able to absorb and dissipate part of the blast-induced stresses in the critical façade components is proposed. To improve the blast reliability of the studied glazing system, specifically, rigid-plastic and elastoplastic devices are introduced at the base and at the top of the vertical bearing cables. Several combinations and mechanical calibrations of these devices are numerically investigated and the most structurally and economically advantageous solution is identified. In conclusion, a simple analytical formulation totally derived from energetic considerations is also suggested for a preliminary estimation of the maximum dynamic effects in single-way cable-supported façades subjected to high-level blast loads.

Keywords: single-way cable-supported façade; explosions; dissipative devices; energy approach; nonlinear dynamic simulations

1. Introduction

During the last decades, an increasing number of buildings have been coated by means of glazing curtain walls. This technological choice, generally associated to primarily architectural and esthetic aspects, currently represents for structural engineers a widespread topic in continuous development.

In this context, numerous authors investigated the behavioral trends of these innovative structural systems, focusing on several aspects and specific loading / boundary conditions (Feng *et al.* 2009, Li *et al.* 2005, Schlaich *et al.* 2005, Weggel *et al.* 2007). Recently, the effects of possible explosive events in the response of such slight systems have also been taken into account and assessed by means of finite-element (FE) numerical investigations, experiments and analytical studies. The design approach for glazing surfaces able to resist explosions (‘*Blast resistant glazing façades’*) is in fact markedly different from the design requirements of buildings subjected to ordinary loads (Baker *et al.* 1983, Norville and Conrath 2001, Schmidt *et al.* 2003).

Firstly, the basic prerequisite of structural systems subjected to explosive loads is the

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