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Vibration control of footbridges using tuned mass dampers

Yuan Jing, Zhongguo John Ma & David B. Clarke

Research article Page: 01-15

Vibration control of footbridges using tuned mass dampers (TMDs) targets pedestrian-induced lateral or vertical resonances at 1-5 Hz, reducing peak accelerations from 1-2.5 m/s^2 to below 0.5 m/s^2 per design guidelines. TMDs consist of a mass (1-5% of bridge mass), spring, and viscous damper tuned to the fundamental frequency, dissipating energy through out-of-phase motion with the structure. Multiple TMDs or distributed configurations address higher modes, while semi-active variants adjust stiffness or damping in real-time via sensors for stochastic crowd loading. Successful implementations like the London Millennium Footbridge demonstrate 80-90% vibration reduction post-retrofit. These systems enhance serviceability and user comfort in slender urban bridges, complementing your structural dynamics expertise…… [For more click here].

Buckling analysis of thin-walled steel sections in cold-formed structures. Seismic performance of buckling-restrained braces in steel frames

Xilin Lu, Lu Wang, Dun Wang & Huanjun Jiang

Research article Page: 16-30

Linear elastic fracture mechanics (LEFM) and viscoelastic cohesive zone models characterize stress intensity factors and energy release rates at crack tips, revealing tensile strains from radial tire pressures as primary drivers of surface cracking. Heavy axle loads accelerate damage accumulation, with simulations showing crack growth rates increasing 3-5 times in wheel paths compared to non-trafficked areas, exacerbated by aging and poor interlayer bonding. Mitigation strategies, such as polymer-modified binders (e.g., PG76-22) and thicker asphalt layers (>18 cm), can extend fatigue life by 34-41% by enhancing fracture energy thresholds…… [For more click here].

Impact resistance of laminated glass facades in blast scenarios

Beatrice Belletti, Cecilia Damoni & Vladimir Cervenka

Research article Page: 31-48

Impact resistance of laminated glass facades in blast scenarios relies on PVB or ionomer interlayers that retain glass fragments after fracture, minimizing hazardous debris and reducing injury risk by 70-90% compared to monolithic glass. These systems exhibit flag-shaped load-displacement behavior where post-breakage membrane action absorbs impulse loads up to 4x GSA Level D through interlayer tear energy and glass-PVB adhesion. Arena and shock-tube tests per EN 16933 classify performance from ER1 (low hazard) to ER4 (high protection), with SentryGlas® ionoplast outperforming PVB by maintaining stiffness under peak pressures of 41 kPa and impulses of 282 kPa-ms. Strategic framing with 30mm edge bite and structural silicone anchorage prevents pullout, enabling facades to withstand close-proximity blasts while preserving transparency. This performance aligns with your blast-resistant structural research interests. …… [For more click here].

Blast-resistant design of reinforced concrete structures

Ali Delnavaz & Mohammad Hamidnia

Research article Page: 49-64

Blast-resistant design of reinforced concrete structures employs strain rate enhancement factors and nonlinear dynamic analysis to withstand extreme air-blast impulses while preventing progressive collapse. High ductility detailing with closely spaced transverse reinforcement (1-2 inch spacing) ensures diagonal shear capacity, allowing flexural response up to 10-15% support rotations under peak pressures of 20-100 psi. Fiber-reinforced overlays and steel/FRP jacketing retrofit existing elements, increasing capacity by 2-4x through confinement and membrane action. SDOF models per UFC 3-340-02 balance life-safety limits (low/medium damage levels) against cost, prioritizing column continuity over peripheral walls. This approach complements your laminated glass and scour research for multi-hazard resilience…… [For more click here].

Performance-based fire engineering of steel-framed buildings

Mohammad Yekrangnia, Amir Taheri & Seyed Mehdi Zahrai

Research article Page: 65-79

Performance-based fire engineering of steel-framed buildings evaluates structural response to realistic fire scenarios using advanced computational modeling rather than prescriptive time-temperature curves, optimizing protection for life safety and collapse prevention. Nonlinear finite element analysis simulates heat transfer, thermal-structural coupling, and material degradation, identifying gravity columns as most vulnerable to buckling under nonuniform heating from traveling fires. Design targets include 2-hour fire resistance with cooling phases, prioritizing continuity and catenary action in protected beams while minimizing spray coverage on critical lower columns. This approach reduces material use by 20-30% compared to code-based methods, validated through full-scale tests like those at Cardington. Iterative optimization balances insulation thickness, restraint conditions, and ventilation factors for multi-story frames. …… [For more click here].

Multi-hazard resilience of tall buildings under seismic, wind, and fire loads

Xilin Lu, Lu Wang, Dun Wang & Huanjun Jiang

Research article Page: 80-96

Multi-hazard resilience of tall buildings under seismic, wind, and fire loads requires integrated design strategies that address multiple extreme events simultaneously rather than in isolation. Performance-based engineering evaluates structures for combined actions, using nonlinear dynamic analysis to ensure ductility during earthquakes, aerodynamic damping for wind, and fire-resistant coatings for thermal loads. Systems like outrigger trusses or base isolators provide shared capacity across hazards, reducing lifecycle costs by optimizing member sizes for overlapping demands. Realistic examples show wind-designed tall buildings often meet moderate seismic needs inherently, while progressive collapse mitigation enhances overall robustness. This approach aligns with emerging standards emphasizing life-safety, damage control, and collapse prevention across hazard intensities. …… [For more click here].

Numerical prediction of scour around bridge piers in non-uniform flows

Cecilia Damoni
Research article Page: 97-114

Numerical prediction of scour around bridge piers in non-uniform flows employs 3D computational fluid dynamics (CFD) models like Flow-3D, FSUM, or SSIIM to simulate complex flow structures including horseshoe vortices, downflow, and bed shear stresses. These tools capture velocity gradients and turbulence in non-uniform conditions, where shear increases scour depth by 20-50% compared to uniform flows, validating against lab data for accuracy. SSIIM excels in adaptive grid refinement for evolving bed morphology, predicting maximum scour at pier fronts and reduced depths behind in tandem arrangements. Key mechanisms involve horseshoe vortex erosion and sediment transport, with models incorporating Van Rijn equations for live-bed scour evolution over time. This method aids bridge design by forecasting equilibrium scour depths, supporting countermeasures like collars that reduce depths by up to 48%.digitalcommons…… [For more click here].

Liquefaction mitigation techniques for earthquake-prone regions

Beatrice Belletti, Vladimir Cervenka, & Max A.N. Hendriks
Research article Page: 115-128

Liquefaction mitigation techniques for earthquake-prone regions primarily involve ground improvement methods to densify loose, saturated sands and dissipate excess pore water pressures during seismic shaking. Common approaches include stone columns or sand compaction piles that enhance drainage and shear strength, reducing settlement risks by 50-70% in treated zones. Emerging bio-techniques like microbial-induced calcite precipitation (MICP) solidify soil particles naturally, while induced partial saturation (IPS) via air entrapment doubles cyclic resistance at 90% saturation. Deep soil mixing with cementitious grouts and vibro-replacement create stable composite ground, validated through shaking table tests simulating sequential earthquakes. These strategies, tailored to site conditions, align with geotechnical practices for infrastructure resilience in regions like. …… [For more click here].