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Durability of GFRP-Reinforced Concrete Beams in Harsh Environments

Ruixin Luo, Xin Wang, Christopher Ha & Abdullah Abdulaziz

Research article Page: 01-14

Durability of GFRP-reinforced concrete beams in harsh environments, such as seawater-sea sand concrete (SWSSC) or alkaline chloride exposure, shows tensile strength retention of 70-85% after accelerated aging, with degradation accelerating under sustained loads. GFRP bars exhibit matrix cracking and fiber-matrix debonding from moisture diffusion and alkaline attack, reducing flexural capacity by 15-30% after 10 years equivalent exposure, though bond strength improves post-fatigue. In subtropical coastal conditions, GFRP beams maintain serviceability with minimal deflection increase, outperforming steel in corrosion-free performance but requiring design strength reductions per ACI 440.1R. Hybrid steel-GFRP configurations optimize longevity, with GFRP handling tensile zones effectively in de-icing salt or marine splash zones…… [For more click here].

Slope Stability Evaluation Using Limit Equilibrium and Finite Element Methods

Aeshah Mohammed Abdullah Nasib, Mohammed Abdulaziz alahmed, Abdulaziz Ali & Kuo-Wei Liao

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Slope stability evaluation using limit equilibrium methods (LEM) divides the slope into slices, assuming a failure surface and satisfying force/moment equilibrium to compute factor of safety (FOS), with methods like Bishop, Janbu, and Morgenstern-Price yielding results within 6% variance. Finite element methods (FEM) incorporate stress-strain relationships via Mohr-Coulomb elastoplastic models and shear strength reduction (SSR) techniques to predict FOS, deformation patterns, and non-circular slip surfaces without presupposing geometry. Comparisons on homogeneous and layered slopes show LEM and FEM FOS values closely matching (differences <5%), but FEM excels in heterogeneous soils, seismic cases, and visualizing plastic zones aligning with circular slip lines. FEM provides superior insights into failure mechanisms and reinforcement optimization, though LEM remains simpler for preliminary design……. [For more click here].

Fire Resistance of Composite Steel-Concrete Beams Protected by Intumescent Coatings

Christopher Ha

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Fire resistance of composite steel-concrete beams protected by intumescent coatings achieves up to 120 minutes by expanding 10-50 times upon heating to form a char barrier that delays steel critical temperature (500-620°C) while concrete slab provides additional insulation. These epoxy-based thin-film coatings (0.5-3 mm DFT) outperform cementitious spray-applied systems in aesthetics, corrosion resistance, and ease of application, with off-site coating enabling quality control for exposed steel. Full-scale furnace tests per ISO 834 or hydrocarbon curves validate performance, showing minimal deflection and shear stud integrity under combined axial/bending loads. Topcoats enhance weatherability and UV stability, critical for hydrocarbon fire scenarios in industrial settings…… [For more click here].

Wireless sensor networks for structural health monitoring

Ali Mohameed Alabdan, Fahad Saud Almotairi, Soliman Ibrahim Al-Abdan, Aishah Shafi Alanazi, Molawwah Nasser Alqahtani & Shoaa G.

Research article Page: 49-68

Wireless sensor networks (WSNs) enable continuous structural health monitoring (SHM) of civil infrastructure like bridges and buildings by deploying low-cost, battery-powered sensors that measure strain, vibration, and temperature without extensive wiring. These networks use protocols like ZigBee or Wi-Fi for real-time data transmission to a central base station, supporting damage detection through acoustic emission and Lamb wave techniques. Key advantages include scalability for hundreds of nodes, reduced installation costs compared to wired systems, and condition-based maintenance that predicts failures early. Challenges involve power management, data synchronization, and harsh environmental resilience, addressed via energy harvesting and embedded algorithms for anomaly detection. Applications in urban settings enhance safety for aging structures, aligning with your interests in vibration control and seismic resilience.…..… [For more click here].

Smart grid optimization for urban energy distribution

Moneef Ibrahim, Almoneef Thamer, Khalifah Alkhalifah, Abdulrahman Sharaf Faisal Alwuthaynani, Razan Hameed, Alsulami Wessal & Hassan Toweirqie

Research article Page: 69-81

Smart grid optimization for urban energy distribution uses advanced sensors and AI to monitor and balance electricity supply with real-time demand in densely populated cities. This approach integrates renewable sources like solar and wind, reducing transmission losses by up to 20% through dynamic load management and predictive analytics. Automated demand response systems shift peak usage to off-peak times, minimizing blackouts and cutting energy costs for consumers. Technologies such as IoT-enabled smart meters and microgrids enhance grid resilience against outages while supporting electric vehicle charging infrastructure. Overall, these optimizations promote sustainable urban growth by lowering CO2 emissions and enabling efficient energy trading. …….… [For more click here]

Drones in construction site monitoring

Mohameed Alabdan, Fahad Almotairi, Soliman Ibrahim Abdan, Aishahi Alanazi & Molawwah Nasser Alqahtani

Research article Page: 82-94

Modifies the tensile response of steel fibre reinforced concrete (SFRC) by altering both the cementitious matrix and the fibre–matrix interface. Over years of service, microstructural densification of the matrix can increase the limit of proportionality and initial tensile strength, while creep and shrinkage still promote crack development. Aging often enhances fibre–matrix bond, which may increase post-cracking residual tensile capacity, but corrosion of exposed steel fibres in aggressive environments can gradually reduce their bridging efficiency. Overall, the long-term tensile performance of SFRC depends on exposure conditions and temperature, with moderate environmental actions showing good retention of residual tensile capacity, whereas severe corrosion or high-temperature histories can cause notable degradation.…… [For more click here]