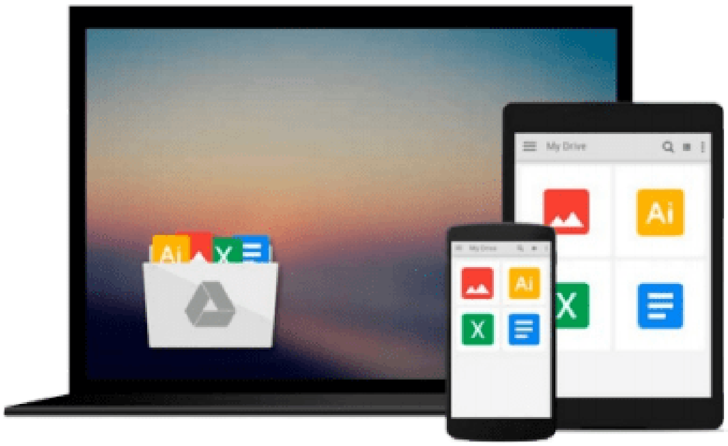

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Strengthening reinforced concrete (RC) members using fiber reinforced polymer (FRP) composites through external bonding has emerged as a viable technique to retrofit/repair deteriorated infrastructure. The interface between the FRP and concrete plays a critical role in this technique. This chapter discusses the analytical and experimental methods used to examine the integrity and long-term durability of this interface. Interface stress models, including the commonly adopted two-parameter elastic foundation model and a novel three-parameter elastic foundation model (3PEF) are first presented, which can be used as general tools to analyze and evaluate the design of the FRP strengthening system. Then two interface fracture models – linear elastic fracture mechanics and cohesive zone model – are established to analyze the potential and full debonding process of the FRP–concrete interface. Under the synergistic effects of the service loads and environments species, the FRP–concrete interface experiences deterioration, which may reduce its long-term durability. A novel experimental method, environment-assisted subcritical debonding testing, is then introduced to evaluate this deteriorating process. The existing small cracks along the FRP–concrete interface can grow slowly even if the mechanical load is lower than the critical value. This slow-crack growth process is known as environment-assisted subcritical cracking. A series of subcritical cracking tests are conducted using a wedge-driven test setup t o gain the ability to accurately predict the long-term durability of the FRP–concrete interface.

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