# Numerical and analytical prediction of the thermal radial cracks in early age GFRP-RC

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**Résumé**

The main of this article is to deal with a numerical and analytical study of the thermal radial
crack in the early age concrete reinforced with GFRP rebar. In fact, the difference between the
radial thermal expansion coefficient of GFRP rebar and its similar of the concrete leads the appearance of cracking in the hardened concrete around the GFRP reinforcement rebar. The early age concrete behavior is described by the hydration process that was numerically developed using the finite element software ABAQUS. Hence, numerical simulations have been established in order to evaluate the cracks behavior in the early age concrete reinforced with GFRP rebar. The thermal strain depending on the concrete's hydration degree has been
taken in account in the numerical simulation. Mazar's damage model has been taken in account
in order to describe the concrete's cracking. An analytical model has been applied on a particular case: early age concrete. In fact, the thermo-mechanical proprieties of early age concrete depend mainly on the hydration degree. The numerical simulations prove the appearance of damage in the early age concrete that exists around the GFRP reinforcement. On
the other hand, a comparison between the numerical results and the analytical ones has been established. A similarity between those results has been deduced. Besides, the time of appearance of the early age and the variation of the radial concrete's stress have been numerically and analytically estimated.

**Mots-Clés:** concrete, thermal strain, GFRP, finite element analysis

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