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Analysis of the new RCC-MRx methodologies for creep-fatigue damage

The design and construction rules for mechanical components of nuclear installations (RCC Codes) published by AFCEN primarily apply to safety class components. RCC-MRx code was developed for sodium-cooled fast reactors (SFR), experimental reactors and fusion reactors but can be used, on condition that the rules applicability is justified, for components for other nuclear installations including the others GEN IV reactors (gas-cooled fast reactors, lead-cooled fast reactors, molten salt reactors, supercritical-water-cooled reactors and very high-temperature reactors). Its specificities are to propose rules for significant creep and significant irradiation domains.

In the 2022 version, the RCC-MRx code introduced new methodologies to calculate more precisely the creep-fatigue damage of a loaded structure.

In a first part, the article presents these new methodologies and their characteristics. Then, they are tested on structures whose design and operating loadings are representative of SFRs. Comparisons between the historical and the new methodologies are performed.

In conclusion, the results show important gains on creep-fatigue damage by using the new methodologies, even if some local areas still present damages higher than allowable limits for a long-life duration. Nevertheless, it allows the designers to focus their work on these few areas.

Country OR International Organization

France

Email address

antoine.martin@framatome.com

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Authors: Mr MARTIN, Antoine (Framatome); Dr MACEDO ALVES DE LIMA, Jean Caio (Framatome); Mr BARBE, Vincent (EDF)

Presenters: Mr MARTIN, Antoine (Framatome); Dr MACEDO ALVES DE LIMA, Jean Caio (Framatome)

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