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Optimization of Passive Safety Devices FAST and SAFE for Sodium-cooled Fast Reactors

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This paper presents two novel passive safety devices for Sodium-cooled Fast Reactors (SFR): SAFE (Static Absorber Feedback Equipment) and FAST (Floating Absorber for Safety at Transient) to deal with the positive coolant void reactivity (CVR) and coolant temperature coefficient (CTC). It is well-known that the positive CVR and CTC limit the maximum performance of a SFR. Especially, CVR and CTC become more positive as the core average burnup of U-loaded SFR increases. Both FAST and SAFE can be easily introduced into an SFR core by replacing some fuel pins or control rods without any complicated core design changes. In this study, the optimum configurations of FAST and SAFE devices in an innovative Sodium-cooled Fast Reactor (iSFR), which is a small (393 MWth) and long-life (>20 years) SFR, are studied in terms of safety parameters, transient responses, and core lifetime.

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