

# Space-based Gravitational Wave Detector Simulation Architecture for Noise Coupling Analysis and System Optimization—Current Status and Future Development

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**Abstract.** There are a few tools for the space-based gravitational wave detector simulation, such as LISACode and Synthetic LISA. However, they are not end-to-end simulation. Therefore, for the complex and tight coupling characteristics of the space-based gravitational wave detectors, based on the existing tools, we hope to extend the simulation capability to support multiple levels of simulations (from system level to instrument level). The simulation architecture designed in this paper mainly includes the following modules: 1) MBSE based space-based gravitational wave detection mission full-cycle multi-dimensional modeling to support multiple resolution of models participating in simulation under long mission development cycle; 2) Open computation module to support flexible simulation model plug-in and multi-disciplinary high-precision and cross-scale calculations; 3) Multi-source noise coupling impact and global sensitivity analysis. This architecture will support multi-source noise coupling analysis and coordinated optimization; provide reference and basis for complex system design and analysis from the scientific objectives to system performance.

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