Optimized Computational Techniques for Time-Division Parallel Algorithm

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Electromagnetic simulationi plays an important role as an essential tool for designing various electromagnetic devices [1]. Recently, a novel technique has been developed to study both time-domain and frequency-domain analysis using a combination of the Finite-Difference Complex-Frequency-Domain (FDCFD) method [2] together with Fast Inverse Laplace transform (FILT) [3]. This combined technique is ideally suitable for realizing parallel implementation. It is simple and error controllable, computational modelling is easy, and efficient parallel computation can be achieved by using computer clusters [4, 5].
In this presentation, we will discuss the way to optimize our algorithm in parallel especially for large scale and long duration problems. A parallel implementation is conducted for both time-domain and complex-frequency-domain and the computational cost can be minimized. Computational accuracy and acceleration of the proposed parallel algorithm will be discussed.

We also apply the similar techniques to heat conduction analysis which is important for designing electric devices [6]. Various numerical methods have been established [7, 8] and the explicit time-domain finite difference method (TD-FDM) is one of powerful computational techniques. TD-FDM is easy implementation and suitable for treating problems consisted of multiple media. Using our proposed technique for heat analysis by TD-FDM, an instantaneous temperature at a specific time can be concisely obtained [9]. We will verify that computational time compared with that of a conventional one can be reduced by selecting the large time step size free from stability limit and using the time-division parallel algorithm.

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