Remarks on Special Issue on Mathematical and Numerical Analysis

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Nearly 70 years have passed since John von Neumann type computers started operation. The computing performance of the current fastest super computer is approximately 10^{14} times that of the first-type computer (ratio of the theoretical peak performance) and that value makes people feel overwhelmed. With such dramatic advancement in the computing performance as a background, various numerical methods from the microscopic to macroscopic scales and, better still, using multiscale and multiphysics modeling have undergone significant development and they are still advancing; example fields are solid mechanics, fluid mechanics, electromagnetics, molecular dynamics, and first-principles calculation. Today, you can use such computing environment and accumulated techniques without any inconvenience. Numerical analysis techniques have gained admittance to manufacturing sites without raising a doubt and have been incorporated into some design procedures in many fields. Lay people can use the computing environment (that is a tool indispensable for the promotion of science and technology efficiently) widely although only a limited number of people could use it 70 years ago.

However, even such high computing performance is not enough for practical analysis in many cases: It is true that the current situation is nowhere near the ideal level. There is a wall that cannot be scaled just by improvement in the computing performance. To understand phenomena by numerical analysis and derive effective results, great ideas are often required like those John von Neumann devised regarding the concept of artificial viscosity to capture shock waves by a finite number of computational grids when he was studying detonation. Researchers should be aware that to devise ways of handling a situation, they must have a thorough knowledge of a target phenomenon and the basic sciences related to that; otherwise you may not see the true form of the actual phenomenon right in front of you. It is extremely important not to solely rely on numerical analysis but to work on things such as analytic mathematical analysis. Researchers need a good understanding of the contents in analytical models customarily and to learn related basic sciences thoroughly. Otherwise, you cannot make the utmost use of this excellent environment. Researchers need to keep honing their skills in daily life.

I always feel envy at the hot water in the bath, saying "I guess you are happy, since your behavior is always true." I desperately look forward to the day when the results of mathematical and numerical analysis show the truth unequivocally. I deliver this special issue with such wish.