國立中山大學應用數學系
學術演講

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講　題：A Call of Stability from a Multiscale Compact Scheme for Subwavelength Meta Optics Applications

時　間：2018/12/28（星期五）16:10 ~ 17:00

地　點：理學院四樓理 SC 4009-1 室

茶　會：15:30 於理 SC 4010 室 (系辦公室)

摘 要

Rapid advances in subwavelength metal optics, e.g. nanophotonics, metamaterials, and plasmonics, have been demanding highly effective, efficient, and yet reliable PDE solvers. This is primarily due to broadband radiation absorptions of the metamaterials. Such optical properties are often tailorable from infrared to visible spectrums. Focusing features of the highly oscillatory beams through subwavelength metamaterials have been extremely difficult to calculate and simulate.

For the simplicity, let us consider a radially symmetric electric field in transverse directions in this conversation. Thus, standard polar coordinates can be employed. To eliminate the transformation singularity occurred, we deploy a transverse domain decomposition which enables a multiscaled environmental setting that allows multi-feature wave approximations. We then consider a multiscaled compact method for a paraxial Helmholtz equation modeling nanobeams focusing through subwavelength holes. The compound numerical method is straightforward, simple-to-use. However, we can show that such a highly accurate compact scheme shies away from the stability in the conventional von Neumann sense.

Can this multiscale algorithm still be vibrating in subwavelength Meta Optics applications? To this end, our investigation extends to a novel new definition of asymptotical stability. The original ideas of the consideration can be traced back to a 2007 INI workshop organized by several outstanding scholars. In our study, highly oscillatory waves for subwavelength material applications are explored. Physical concerns are once again placed before traditional mathematical arguments. Intensive auxiliary expansions and analysis are carried out. It is proven that, while appropriate constraints are reinforced, the asymptotical stability of aforementioned multiscale compact method remains affective. Computational experiments with laboratorial validations will be given to illustrate our conclusions. We shall look for further collaborations in the field with Taiwanese colleagues and students.

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