Electromagnetic properties of gain-doped epsilon-near-zero metamaterials KA KI NG, NAIJING DENG, KIN WAH YU, The Chinese University of Hong Kong — Sun and Yu designed broadband gain-doped epsilon-near-zero (GENZ) metamaterials in 2012. The large loss of epsilon-near-zero metamaterials is compensated by gain to get a great advantage in practical applications. Previous works have demonstrated that the electromagnetic properties of gain media differ from that of lossy media. For example, the original Kramers-Kronig relations are no longer suitable for certain gain media. Therefore, we have studied the electromagnetic properties of GENZ and determined whether it is possible to develop such relations for GENZ over a broad frequency range. In order to investigate the validity of Kramers-Kronig relations for GENZ, we have studied the electromagnetic properties of a GENZ slab which is considered as a homogeneous layer with frequency dependent permittivity. The associated Fresnel equations for GENZ is studied using Laplace transform analysis. The changes caused by the two pumped sources at lower and higher frequencies is demonstrated. Finally, the associated Kramers-Kronig relation is validated after a contact with the causality and electromagnetic properties of active media.

Ka Ki Ng
The Chinese University of Hong Kong