

EE540 Advance Electromagnetic Theory & Antennas

Prof. Rakesh S. Kshetrimayum

Dept. of EEE, IIT Guwahati, India



Electromagnetic Theorems and Concepts

- **Method of Images:**
- Consider the image current problem
 - of a horizontal current element J above an infinite conducting plane at a distance d
- We may consider image theory equivalence
- Remove the conducting boundary
 - and introduce a horizontal image current element J' of same magnitude as J
 - but flowing in the opposite direction
 - and kept at a distance d from the boundary surface
- The current J and J' together produce
 - zero tangential electric field on the boundary surface



Electromagnetic Theorems and Concepts

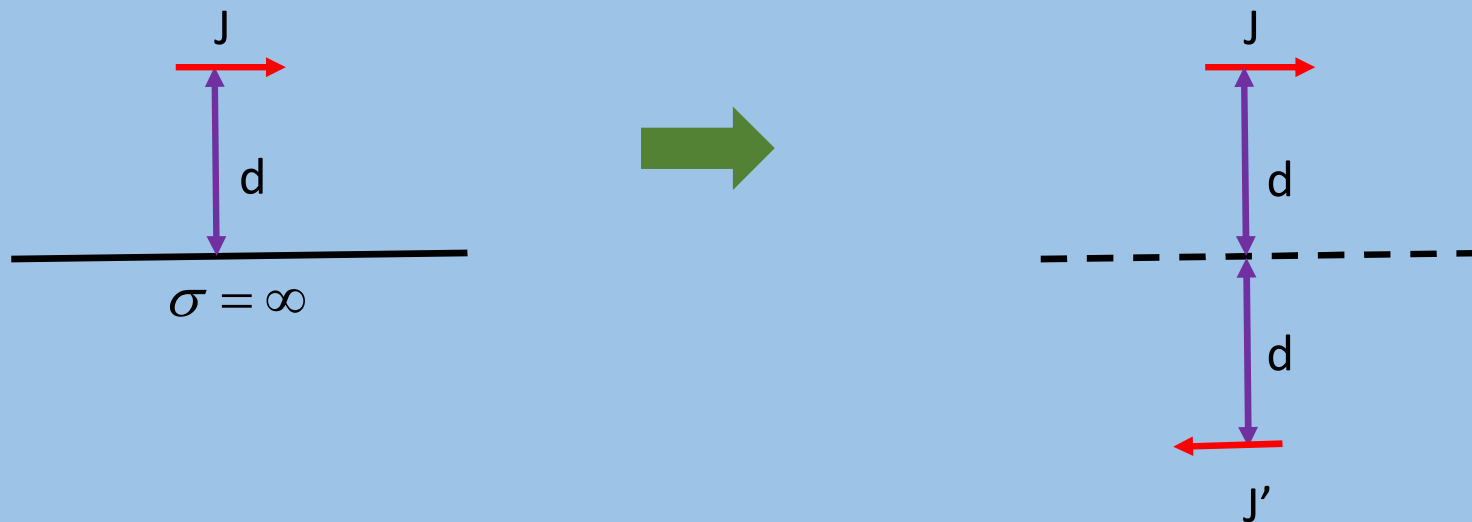


Fig. Classic image current problem



Electromagnetic Theorems and Concepts

- **Justification using Uniqueness theorem**
- Since the original boundary condition of
 - zero tangential electric field is satisfied
- Uniqueness theorem ensures
 - that the field in the upper half is the same
 - as in the original problem
- Let us summarize Image principle for
 - *electric wall* and
 - *magnetic wall*



Electromagnetic Theorems and Concepts

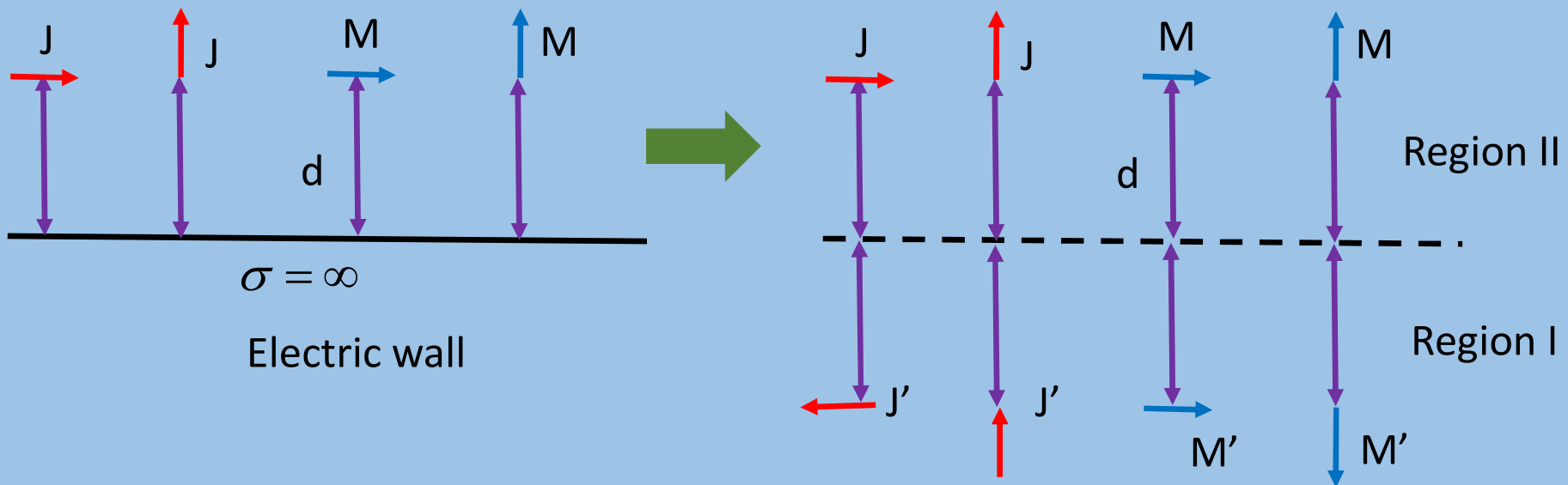


Fig. Classic image current problem for electric wall



Electromagnetic Theorems and Concepts

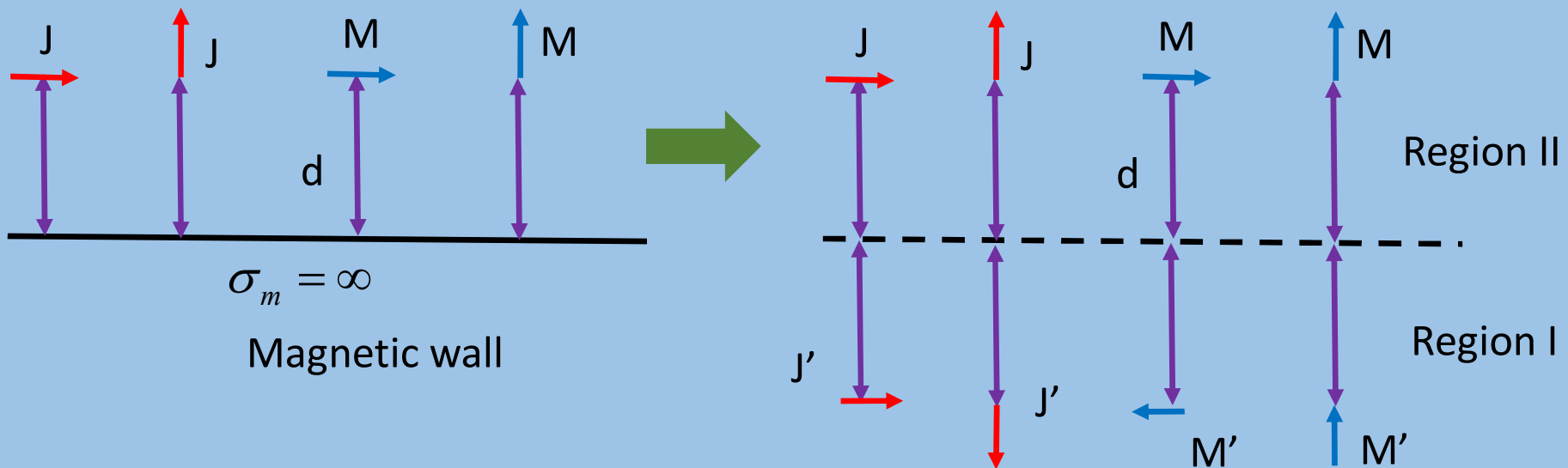


Fig. Classic image current problem for magnetic wall



Electromagnetic Theorems and Concepts

- Principle of constructing the image remains the same
 - the image and the original source together
 - should produce the same fields as existing on the boundary
 - so that the boundary can be deleted
 - without affecting the fields in the region of interest
- Also note any arbitrary current distribution for application of image principle
 - can be decomposed into two components
 - parallel (represented by horizontal sources) and
 - perpendicular (represented by vertical sources)
 - to the reflecting surface