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Field description for magnets I

Monday 20 November 2023 11:00 (1 hour)

Instead of asking what are vector fields, or what is the difference between the magnetic field intensity H and the magnetic flux density B, it is more meaningful to ask what they do or describe: Vector fields are mappings that assign to each point of the domain, one and only one bound vector from the domain's tangent space. Electric fields, represented by the gradient of a scalar field, require a three-dimensional affine (point) space and a scalar product of its associated linear (vector) space. Magnetic fields need an orientation for all operations involving cross-products.
The constitutive (material) equations also require a metric, which can be seen from their physical units, for example, Vs/Am for the permeability.
it is clear that a rich mathematical structure is required, and violation of this structure may lead to confusion and pitfalls in analytical and numerical
field computations, such as force and energy calculations, Faraday paradoxes etc.

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