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Computer simulation of microwave propagation in heterogeneous and fractal media

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Abstract. Maxwell's equations (MEs) are the starting point for all calculations involving surface or borehole electromagnetic (EM) methods in Petroleum Industry. In well-log analysis numerical modeling of resistivity and induction tool responses has become an indispensable step of interpretation. We developed a new method to numerically simulate electromagnetic wave propagation through heterogeneous and fractal slabs taking into account multiple scattering in the direction of normal incidence. In simulation, the gray-scale image of the porous medium is explored by monochromatic waves. The gray-tone of each pixel can be related to the dielectric permittivity of the medium at that point by two different equations (linear dependence, and fractal or power law dependence). The wave equation is solved in second order difference approximation, using a modified sweep technique. Examples will be shown for simulated EM waves in carbonate rocks imaged at different scales by electron microscopy and optical photography. The method

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