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Seismic Modeling on Complex Media

Eldues Oliveira Martins[1], *Djalma Manoel Soares Filho*[2], *Josias José da Silva*[1], *Luiz Landau*[1], *and Jorge Luiz Costa*[1]. *(1) LAMCE/COPPE/UFRJ, Universidade Federal do Rio de Janeiro, Centro de Tecnologia, Bloco I-2000, Sala I-214, Rio de Janeiro, 21949900, Brazil, phone: 55 21 25628432, eldues.martins@lab2m.coppe.ufrj.br, (2) CENPES/PETROBRAS, PETROBRAS SA, Cidade Universitária / Ilha do Fundão, Rio de Janeiro, 21949900, Brazil*

Two finite differences type methods are introduced for seismic modeling on transversely isotropic media. The first one is designed for seismic acquisition simulations on on-shore geologic models and consists of a modification of the Zahradník and Priolo (1994) proposal to accommodate seismic modeling on anisotropic media. In this method, the components of the displacement vector are discretized in a regular grid and the elastic tensor components are introduced through vertical and horizontal integrations along the grid lines. Second order approximations are used for spatial and temporal derivatives and Vacuum Formalism, as it is posed in Zahradník, Moczo and Heron (1993), is used as boundary condition along the upper interface. This technique is not restricted to flat observation surfaces, but it cannot be used on off-shore models, since it gives rise to instabilities where shear modulus is small. The second method is based on Levander (1986) proposal technique and is indicated to seismic simulations on off-shore geologic models. As it was done with the Zahradník and Priolo (1986) method, we also adapt this second one to cope with transversely isotropic media. In this case, the components of the velocity field and the elastic parameters are defined in a staggered grid and the conditions for preventing spurious numerical dispersions do not depend on shear modulus value. In relation to partial derivatives approximations, the temporal derivatives are approximated in second order whereas the spatial ones are fourth-order approximated. Both methods are not restricted to any particular acquisition pattern and may be applied to any geologic case.