Seismic Modeling, Migration, and Velocity Inversion

Questions

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Outline

Questions
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1. A chief cause of anisotropy in rocks is due to
   a. Rock texture such as lamination, fractures or cracks
   b. The volume of absorbed fluids
   c. Sub-areal exposure
   d. Metamorphosis

2. Exposed shales are easily recognize by
   a. Lamination
   b. Talus slopes
   c. Their characteristic black color
   d. The number of fossils

3. Shear velocities in rocks are
   a. A function of their compressional modulus
   b. A function of the shear modulus
   c. Both a and b
   d. None of the above

4. Orthorhombic isotropy is characterized by
   a. Five independent volumes
   b. Twenty-one independent volumes
   c. Nine independent volumes
   d. Eighteen independent volumes
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5. Tilted Transverse Isotropy refers to
   a. Orthorhombic isotropy with a vertical symmetry axis
   b. Vertical Transverse Isotropy with a tilted axis of symmetry
   c. An isotropic elastic medium with a horizontal symmetry axis
   d. None of the above

6. Beam migrations are based on
   a. Ray tracing light beams in constant velocity
   b. Estimates of the local subsurface dip
   c. Estimates of apparent dip
   d. Smearing trace amplitudes over equal travel time curves

7. The difference between time and depth migration is
   a. None
   b. Time images along image rays while depth images along vertical rays
   c. Time images along vertical rays while depth images along image rays
   d. Time uses a full 3D velocity volume while depth does not

8. The migration approach that is closest to true amplitude is
   a. Full two-way (reverse time migration)
   b. Kirchhoff prestack time migration
   c. Gaussian Beam migration
   d. One-way phase screen with one additional bounce
9. Two distinct rays arriving at a fixed subsurface point
   a. Can have identical take-off angles
   b. Can have identical incident angles
   c. Can have different take-off angles but identical incidence angles
   d. None of the above

10. The full wave-equation is based on
    a. Newton’s second law of motion and Hooke’s law
    b. Hooke’s law
    c. Newton’s second law of motion
    d. Newton’s law of gravitational attraction

11. Forward modeling
    a. Has no part in seismic migration
    b. It’s the basis for all migration algorithms
    c. Is used to forward propagate time-reversed trace
    d. Both b and c

12. The aliasing of dipping events
    a. Is related only to dip
    b. Is related to dip and frequency
    c. Is a relationship between surface spacing, dip, and frequency
    d. None of the above
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13. Mathematically, wave equation based migration algorithms
   a. Assume that the Earth consists of flat layers
   b. Assume that the sources and receivers are actually arrays
   c. Assume that sources and receivers are point sources and receivers
   d. Assumes a line source and are point receivers

14. Kirchhoff migration
   a. Is not wave equation based
   b. Is based on an approximation to the wave equation
   c. Cannot resolve steeply dipping events
   d. Both b and c

15. Phase Screen migration
   a. Is a full two-way method
   b. Is not based on factorization of the wave equation
   c. Correctly handles dips steeper than 90 degrees
   d. Cannot images turning rays

16. Gaussian Beam migration
   a. Is misnamed. It's not really a beam based method
   b. Is a beam based method that images only on the central ray
   c. Is a beam based method that images only off the central ray
   d. Is a beam based method that images along and off the central ray
17. When properly implemented, Gaussian Beam migration
   a. Is very close to a true two-way method
   b. Is the best one-way method available
   c. Images up to 108 degrees but no higher
   d. Is based on factorization of the wave equation into two one-way equations

18. Full waveform inversion
   a. Computes AVO slope and intercept to estimate subsurface velocities
   b. Had nothing to do with modeling or migration
   c. Is based on full waveform modeling and migration
   d. Can be applied only to marine data

19. Full waveform inversion
   a. Can only be used in 2D
   b. Is an iterative scheme using RTM to calculate the velocity model update
   c. Can only be used in 3D
   d. Calculates the velocity model update through tomographic raytracing

20. According to mathematical theory
   a. Migration is independent of acquisition geometry and design
   b. Migration requires acquisition at the largest possible spacings
   c. Wide azimuth densely spaced acquisition is optimum
   d. None of the above
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21. Acquisition design
   a. Has no affect on frequency content
   b. Is independent of sample increments
   c. Is optimum when the spacing is as large as possible
   d. Is optimum when the spacing is as small as possible

22. $V_{nmo}$ velocity is defined to be
   a. The best estimate of vertical or well velocity
   b. When divided by two is a good estimate of horizontal shear velocity
   c. The best estimate of horizontal velocity
   d. The velocity that produces the best isotropic migration image

23. The anisotropic parameter $\delta$
   a. Can be thought of as governing horizontal wave speed
   b. Can be thought of as governing percentage depth miss ties
   c. Is the ratio of the horizontal velocity to the vertical velocity minus 1
   d. Is a function of the two shear velocities in anisotropic propagation

24. The anisotropic parameter $\epsilon$
   a. Can be thought of as governing horizontal wave speed
   b. Can be thought of as governing percentage depth miss ties
   c. Is given by the formula $0.5 \left( \frac{V_{nmo}}{V_{vert}} - 1 \right)$
   d. Is a function of the two shear velocities in anisotropic propagation
25. Anisotropic waves
   a. Consists of a compressional and two shear waves
   b. Propagate with velocities that are angle dependent
   c. Constantly convert from one type to the other
   d. All of the above

26. Based on theory and case studies
   a. Single linear array of receivers produces the best results
   b. Wide azimuth acquisition is better than all other methods
   c. Optimal acquisition is independent of receiver placement
   d. None of the above

27. Theoretical analysis, case studies, and synthetic tests
   a. Show that full waveform inversion does not work
   b. Show that inversion depends mostly on high frequencies
   c. Show that full waveform always performs perfectly
   d. Show that inversions strongly depend on low frequencies

28. Migration algorithms
   a. Cannot provide information about velocity errors
   b. Provide algorithm dependent indicators of velocity errors
   c. Are insensitive to velocity errors
   d. Work best when applied in the time domain
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29. All depth migration algorithms can be thought of as
   a. Forward and backward propagation coupled by an imaging condition
   b. A lateral shift followed by a vertical shift
   c. Finding the termination of an apparent dip based ray
   d. All of the above

30. Raytracing is an integral part of
   a. Gaussian Beam Migration
   b. Classical Beam Migration
   c. Kirchhoff Migration
   d. All of the above

31. Raytracing is not an integral part of
   a. Reverse Time Migration
   b. Gaussian Beam Migration
   c. Kirchhoff Migration
   d. All of the above

32. Kirchhoff Migration
   a. Is not based on the wave equation
   b. Is a full waveform method
   c. Is based on the wave equation
   d. All of the above
Questions?