Claims

1. A high-angle fracture prediction method applied in oil and gas exploration and implemented by a computer device comprising an input unit, a processor and a memory, the method comprising the following steps of:

performing, by the processor, a first azimuthal anisotropy inversion on wide azimuth seismic data of a target region based on a constructed isotropic low-frequency model, to acquire a first anisotropy intensity;

performing, by the processor, P-wave fast and slow velocity anisotropy analysis on the wide azimuth seismic data of the target region, to acquire anisotropy of P-wave fast and slow velocity difference and a fast P-wave velocity direction;

fitting, by the processor, the first anisotropy intensity and the anisotropy of P-wave fast and slow velocity difference, to acquire a P-wave fast and slow velocity difference-based anisotropy intensity;

establishing, by the processor, an azimuthal P-wave anisotropic low-frequency model according to the P-wave fast and slow velocity difference-based anisotropy intensity and the fast P-wave velocity direction;

performing, by the processor, a second azimuthal anisotropy inversion on the wide azimuth seismic data of the target region based on the azimuthal P-wave anisotropic low-frequency model, to acquire a second anisotropy intensity and a second anisotropy direction; and

analyzing, by the processor, the second anisotropy intensity and the second anisotropy direction, to acquire a fracture prediction result;

wherein fitting, by the processor, the first anisotropy intensity and the anisotropy of P-wave fast and slow velocity difference in accordance with the following formula, to acquire the P-wave fast and slow velocity difference-based anisotropy intensity:

$$b_{1v} = -0.23 \times J - 0.005;$$

wherein, b_{1v} denotes P-wave fast and slow velocity difference-based anisotropy intensity; and J denotes anisotropy of the P-wave fast and slow velocity difference;

wherein establishing, by the processor, the azimuthal P-wave anisotropic low-frequency model in accordance with the following formula, according to the P-wave fast and slow velocity difference-based anisotropy intensity and the fast P-wave velocity direction:

$$\left(\frac{V_p}{V_s}\right)_{01} \approx e^{2b_{1v}*\cos^2(\omega-\phi_v)} \bullet \left(\frac{V_p}{V_s}\right)_0;$$

wherein, V_p denotes a P-wave velocity, V_s denotes an S-wave velocity, b_{1v} denotes P-wave fast and slow velocity difference-based anisotropy intensity, ω denotes an azimuthal angle of the seismic data, ϕ_v denotes a direction perpendicular to the fast P-wave velocity, $\left(\frac{V_p}{V_s}\right)_{01}$ denotes the anisotropic low-frequency model of the azimuthal P-wave, and $\left(\frac{V_p}{V_s}\right)_0$ denotes an isotropic low-frequency model.

2. The high-angle fracture prediction method according to claim 1, wherein performing, by the processor, a first azimuthal anisotropy inversion on wide azimuth seismic data of a target region based on a constructed isotropic low-frequency model, to acquire a first anisotropy intensity comprises the following steps of:

the wide azimuth seismic data of the target region is divided and stacked in a manner of dividing the azimuthal angle at first and then dividing an offset, to form multiple partial angle stacked seismic data with different azimuths;

performing an azimuth anisotropy inversion on the multiple partial angle stacked seismic data of different azimuths based on the constructed isotropic low-frequency model, to acquire a divided azimuthal P-wave and S-wave velocity ratio; and

determining the first anisotropy intensity according to the divided azimuthal P-wave and S-wave velocity ratio.

3. The high-angle fracture prediction method according to claim 1, wherein performing, by the processor, P-wave fast and slow velocity anisotropy analysis on the wide azimuth seismic data of the target region, to acquire anisotropy of P-wave fast and slow velocity difference and a fast P-wave velocity direction comprises the following steps of:

processing the wide azimuth seismic data of the target region, to acquire a fast P-wave velocity, a slow P-wave velocity and a fast P-wave velocity direction; and

determining anisotropy of the P-wave fast and slow velocity difference based on the fast P-wave velocity and the slow P-wave velocity.

4. A computer device applied in oil and gas exploration, comprising a memory, a processor, an input unit, and a computer program stored on the memory and executable by the processor, wherein when executing the computer program, the processor implements the following steps of:

performing a first azimuthal anisotropy inversion on the wide azimuth seismic data of a

target region based on a constructed isotropic low-frequency model, to acquire a first anisotropy intensity;

performing P-wave fast and slow velocity anisotropy analysis on the wide azimuth seismic data of the target region, to acquire anisotropy of P-wave fast and slow velocity difference and a fast P-wave velocity direction;

fitting the first anisotropy intensity and the anisotropy of P-wave fast and slow velocity difference, to acquire a P-wave fast and slow velocity difference-based anisotropy intensity;

establishing an azimuthal P-wave anisotropic low-frequency model according to the P-wave fast and slow velocity difference-based anisotropy intensity and the fast P-wave velocity direction;

performing a second azimuthal anisotropy inversion on the wide azimuth seismic data of the target region based on the azimuthal P-wave anisotropic low-frequency model, to acquire a second anisotropy intensity and a second anisotropy direction; and

analyzing the second anisotropy intensity and the second anisotropy direction, to acquire a fracture prediction result;

wherein fitting, by the processor, the first anisotropy intensity and the anisotropy of P-wave fast and slow velocity difference in accordance with the following formula, to acquire the P-wave fast and slow velocity difference-based anisotropy intensity:

$$b_{1v} = -0.23 \times J - 0.005;$$

wherein, b_{1v} denotes P-wave fast and slow velocity difference-based anisotropy intensity; and J denotes anisotropy of the P-wave fast and slow velocity difference; and

wherein establishing, by the processor the azimuthal P-wave anisotropic low-frequency model in accordance with the following formula, according to the P-wave fast and slow velocity difference-based anisotropy intensity and the fast P-wave velocity direction:

$$\left(\frac{V_p}{V_s}\right)_{01} \approx e^{2b_{1v}*\cos^2(\omega-\phi_v)} \bullet \left(\frac{V_p}{V_s}\right)_0;$$

wherein, V_p denotes a P-wave velocity, V_s denotes an S-wave velocity, b_{1v} denotes P-wave fast and slow velocity difference-based anisotropy intensity, ω denotes an azimuthal angle of the seismic data, ϕ_v denotes a direction perpendicular to the fast P-wave velocity,

$\left(\frac{V_p}{V_s}\right)_{01}$ denotes the anisotropic low-frequency model of the azimuthal P-wave, and $\left(\frac{V_p}{V_s}\right)_{0}$ denotes an isotropic low-frequency model.

5. The computer device according to claim 4, wherein when executing the computer program, the processor implements the following steps of:

the wide azimuth seismic data of the target region is divided and stacked in a manner of dividing the azimuthal angle at first and then dividing an offset, to form multiple partial angle stacked seismic data with different azimuths;

performing an azimuth anisotropy inversion on the multiple partial angle stacked seismic data of different azimuths based on the constructed isotropic low-frequency model, to acquire a divided azimuthal P-wave and S-wave velocity ratio; and

determining the first anisotropy intensity from the divided azimuthal P-wave and S-wave velocity ratio.

6. The computer device according to claim 4, wherein when executing the computer program, the processor implements the following steps of:

processing the wide azimuth seismic data of the target region, to acquire a fast P-wave velocity, a slow P-wave velocity and a fast P-wave velocity direction; and

determining anisotropy of the P-wave fast and slow velocity difference based on the fast P-wave velocity and the slow P-wave velocity.

7. A computer-readable storage medium applied in oil and gas exploration, wherein the computer-readable storage medium, a processor and an input unit are comprised in a computer device, the computer-readable storage medium stores a computer program for implementing the following steps of:

performing, by the processor, a first azimuthal anisotropy inversion on wide azimuth seismic data of a target region based on a constructed isotropic low-frequency model, to acquire a first anisotropy intensity and;

performing, by the processor, P-wave fast and slow velocity anisotropy analysis on the wide azimuth seismic data of the target region, to acquire anisotropy of P-wave fast and slow velocity difference and a fast P-wave velocity direction;

fitting, by the processor, the first anisotropy intensity and the anisotropy of P-wave fast and slow velocity difference, to acquire a P-wave fast and slow velocity difference-based anisotropy

intensity;

establishing, by the processor, an azimuthal P-wave anisotropic low-frequency model according to the P-wave fast and slow velocity difference-based anisotropy intensity and the fast P-wave velocity direction;

performing, by the processor, a second azimuthal anisotropy inversion on the wide azimuth seismic data of the target region based on the azimuthal P-wave anisotropic low-frequency model, to acquire a second anisotropy intensity and a second anisotropy direction; and

analyzing, by the processor, the second anisotropy intensity and the second anisotropy direction, to acquire a fracture prediction result;

wherein fitting, by the processor, the first anisotropy intensity and the anisotropy of P-wave fast and slow velocity difference in accordance with the following formula, to acquire the P-wave fast and slow velocity difference-based anisotropy intensity:

$$b_{1v} = -0.23 \times J - 0.005;$$

wherein, b_{1v} denotes P-wave fast and slow velocity difference-based anisotropy intensity; and J denotes anisotropy of the P-wave fast and slow velocity difference; and

wherein establishing, by the processor, the azimuthal P-wave anisotropic low-frequency model in accordance with the following formula, according to the P-wave fast and slow velocity difference-based anisotropy intensity and the fast P-wave velocity direction:

$$\left(\frac{V_p}{V_s}\right)_{01} \approx e^{2b_{1v}*\cos^2(\omega-\phi_v)} \bullet \left(\frac{V_p}{V_s}\right)_0;$$

wherein, V_p denotes a P-wave velocity, V_s denotes an S-wave velocity, b_{1v} denotes P-wave fast and slow velocity difference-based anisotropy intensity, ω denotes an azimuthal angle of the seismic data, ϕ_v denotes a direction perpendicular to the fast P-wave velocity, $\left(\frac{V_p}{V_s}\right)_{01}$ denotes the anisotropic low-frequency model of the azimuthal P-wave, and $\left(\frac{V_p}{V_s}\right)_0$ denotes an isotropic low-frequency model.

8. The computer-readable storage medium according to claim 7, wherein the computer program for implementing the following steps of:

the wide azimuth seismic data of the target region is divided and stacked in a manner of dividing the azimuthal angle at first and then dividing an offset, to form multiple partial angle stacked seismic data with different azimuths;

performing an azimuth anisotropy inversion on the multiple partial angle stacked seismic data of different azimuths based on the constructed isotropic low-frequency model, to acquire a divided azimuthal P-wave and S-wave velocity ratio; and

determining the first anisotropy intensity according to the divided azimuthal P-wave and S-wave velocity ratio.

9. The computer-readable storage medium according to claim 7, wherein the computer program for implementing the following steps of:

processing the wide azimuth seismic data of the target region, to acquire a fast P-wave velocity, a slow P-wave velocity and a fast P-wave velocity direction; and

determining anisotropy of the P-wave fast and slow velocity difference based on the fast P-wave velocity and the slow P-wave velocity.