Question 9

Q: Can Femtet perform the analysis with absorption or damping taken into account?

A: Yes, Femtet can do it.

Applying an imaginary part to sound speed allows the analysis with absorption or damping taken into account

The imaginary part of sound speed represents damping. The imaginary part can be used at ultrasonic frequencies where damping cannot be neglected and when a sound-absorbing material is used for damping sound waves.

Kirchihoff's theoretical formula shown below represents the damping of sound waves, indicating the damping increases with higher frequency.

$$c_{image} = \frac{\omega}{2c}\left(\frac{4\mu}{3\rho} + \frac{\gamma-1}{\gamma}\frac{\kappa}{\rho C_v}\right)$$

where ω: Angular frequency, c: Sound speed, μ: Viscocity coefficient, ρ: Density,
γ: Specific heat, Cv: Specific heat at constant volume, 2.7e − 7f for air and 2.8e − 9f for water
f: Frequency.