Analysis of Hydrodynamic Plain Journal Bearing

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Introduction: Hydrodynamic type journal bearings are considered to be a vital component of all rotating machinery. This poster represents the simulation of fluid film of lubricant in hydrodynamic plain journal bearing using COMSOL software.
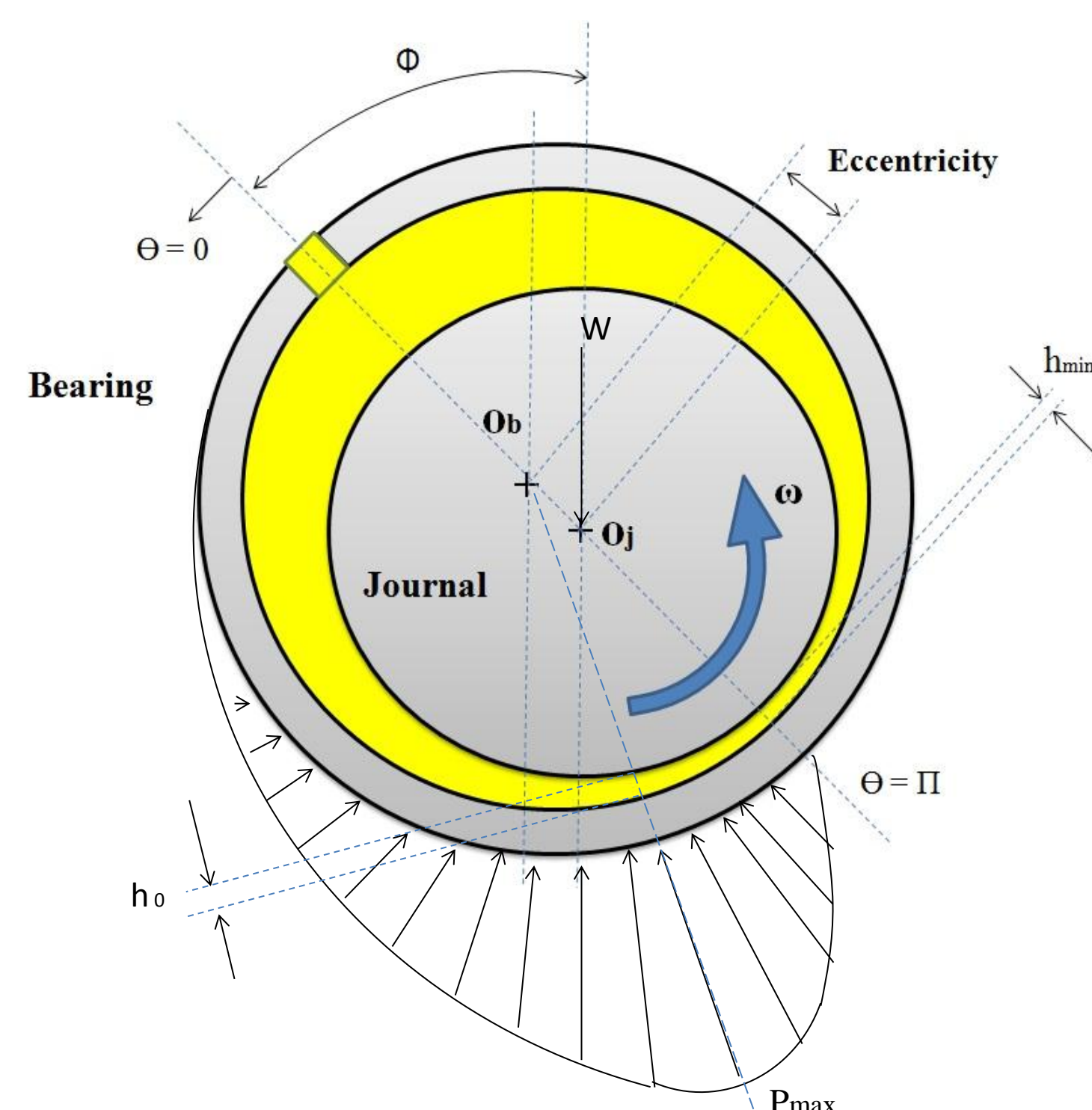
Computational Methods: Generalized Reynolds equation is used to obtain the pressure distribution using Sommerfeld boundary conditions. The hydrodynamic theory applied to the hydrodynamic lubricated bearing is mathematically explained by Reynolds's Equation.

$$\frac{\partial}{\partial x}\left(\frac{h^3}{\mu}\frac{\partial p}{\partial x}\right) + \frac{\partial}{\partial z}\left(\frac{h^3}{\mu}\frac{\partial p}{\partial z}\right) = 6U\frac{\partial h}{\partial x}$$

Figure 1. Hydrodynamic journal bearing.

Figure 2. Fluid element from hydrodynamic film.

Figure 3. Pressure distribution for LJB using full Sommerfeld condition at eccentricity ratio, ε = 0.5.
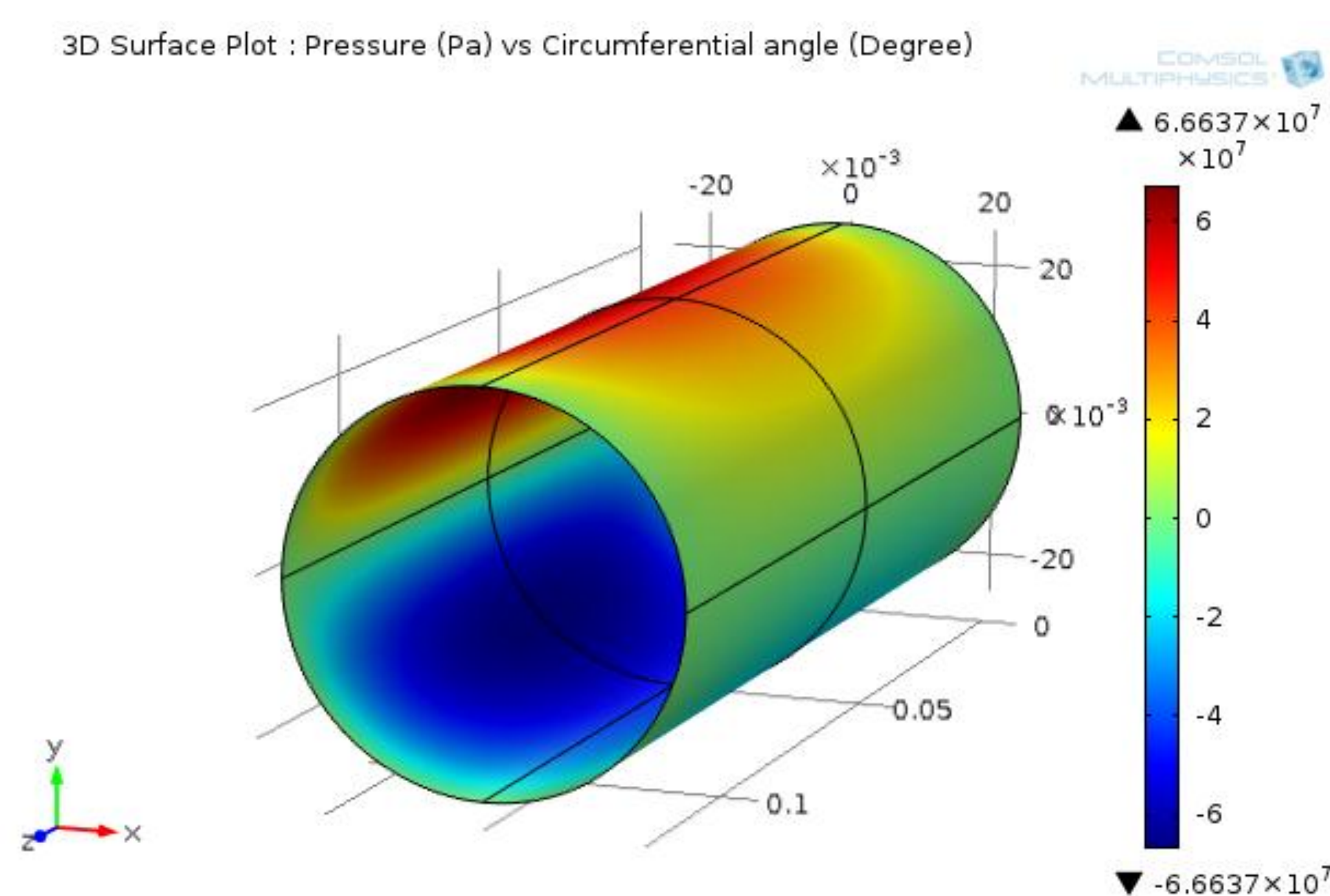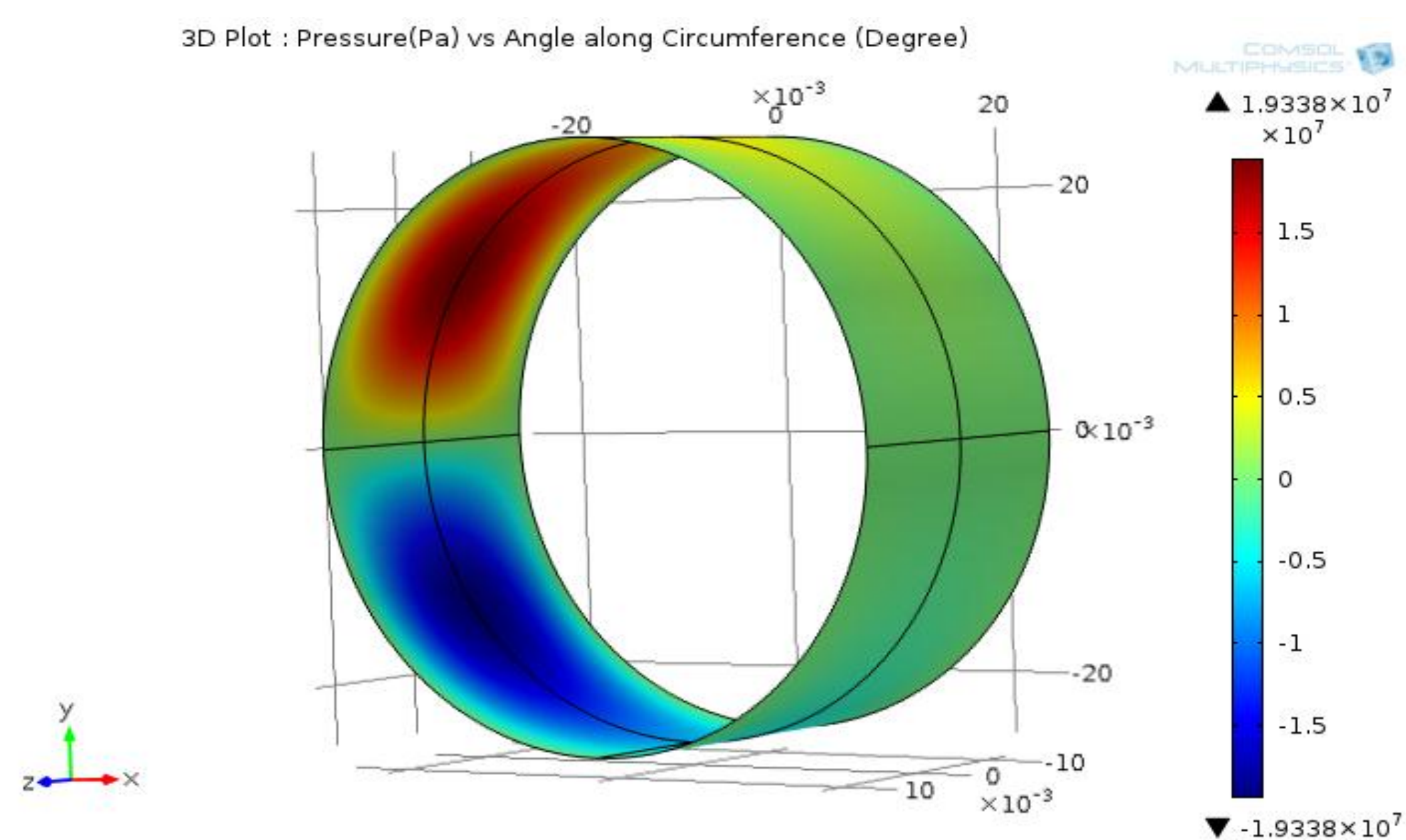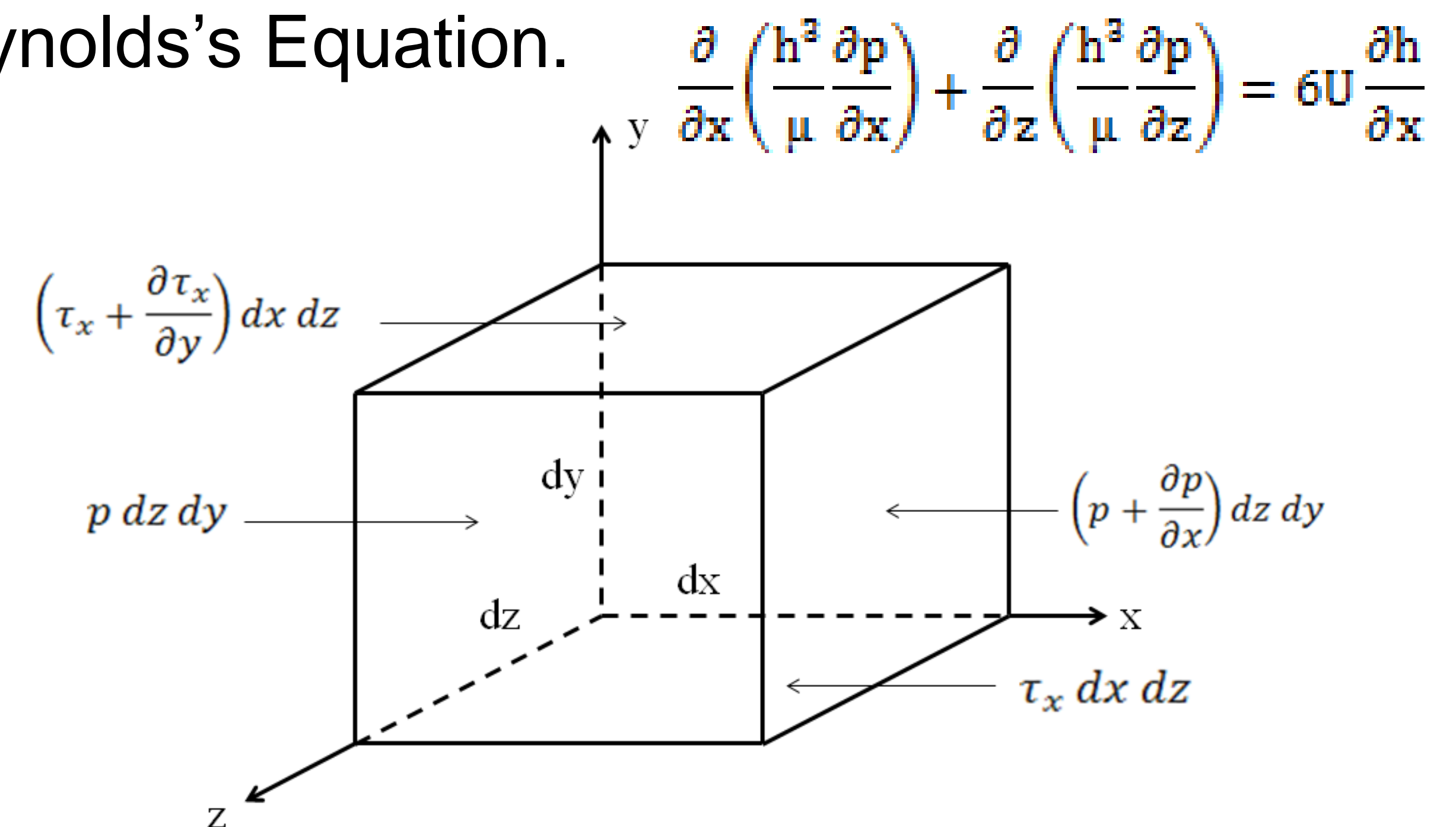

Figure 4. Comparison of analytical and simulated pressure distribution for LJB using full Sommerfeld condition at eccentricity ratio, ε = 0.5.

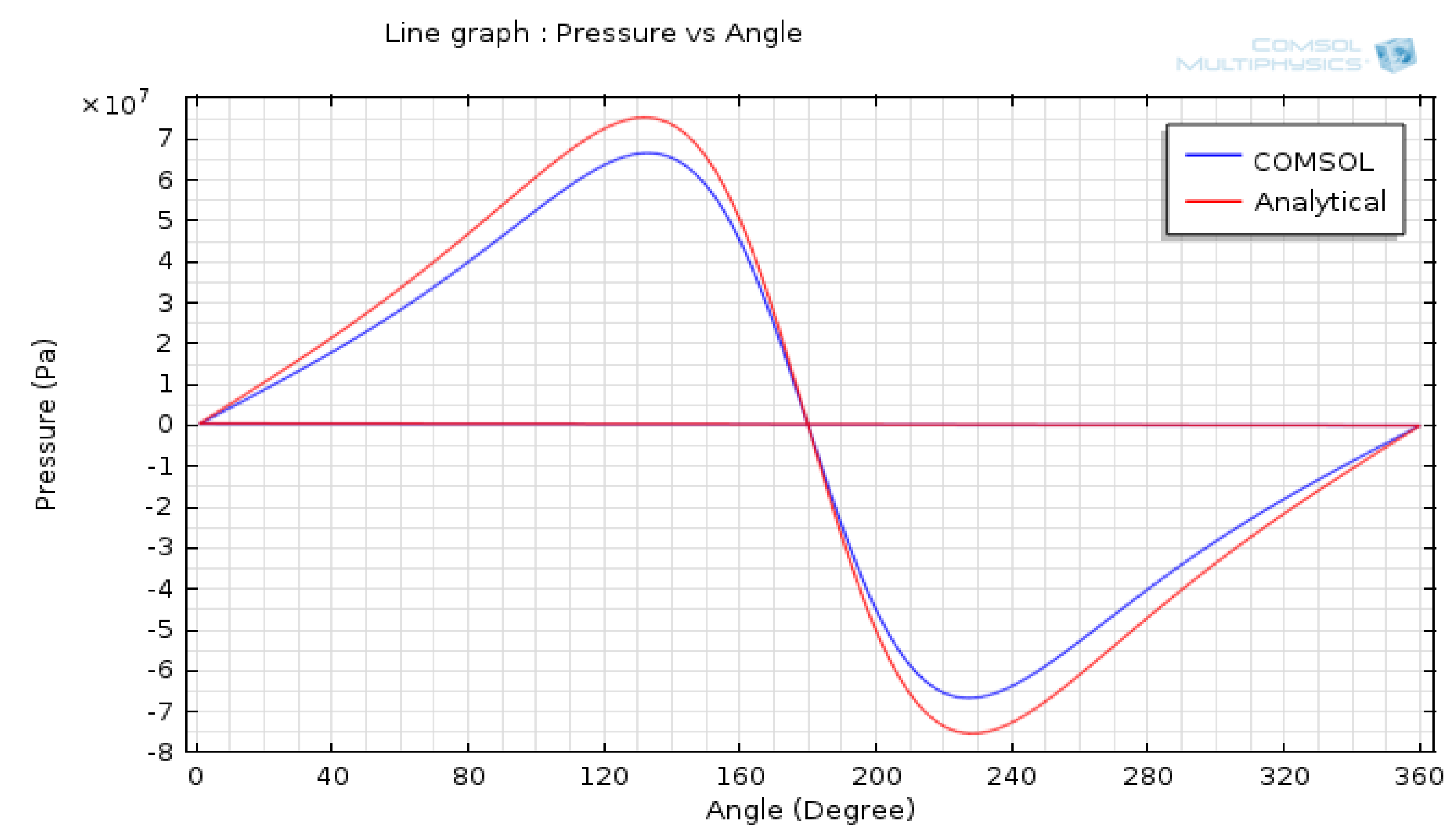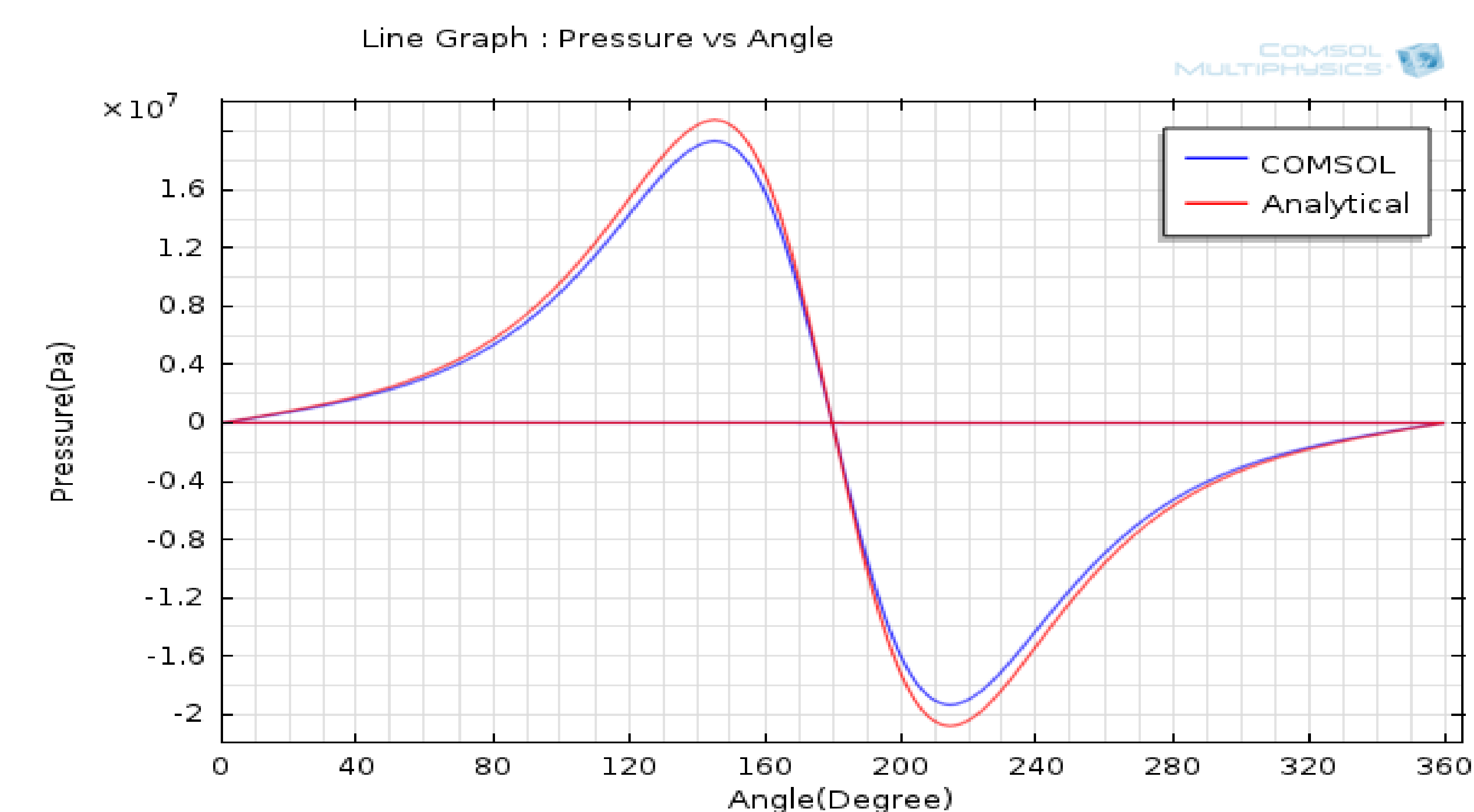**Figure 5**. Pressure distribution for SJB using full Sommerfeld condition at eccentricity ratio, ε = 0.5.

Figure 6. Comparison of analytical and simulated pressure distribution for SJB using full Sommerfeld condition at eccentricity ratio, ε = 0.5.

Conclusion:

✓ Application of General governing Reynolds equation.

✓ COMSOL gives approximately identical solution to analytical solution.

✓ At lower eccentricity values COMSOL predicts a slightly lower maximum pressure while at the higher values of eccentricity it predicts a slightly higher maximum pressure.

Future scope:

➢ Thermodynamic analysis.

➢ Dynamic analysis.

References:

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