The power steering unit shown uses a 4-way valve which can be modeled as a variable 2-port resistor attached to a pressure source.

The relation between the pressure across the ram, $P_m$, and the flow rate, $Q_m$, is modulated by the relative valve displacement $z$.

(Note that piston rod area is neglected.)

The relation between the pressure across the ram, $P_m$, and the flow rate, $Q_m$, is modulated by the relative valve displacement $z$.

$\frac{P_s}{P_m} = \frac{z}{1}$

On the next page, make a clear bond graph for this system including all effects indicated on the schematic diagram.

Apply causality and state how many state equations would be needed to simulate the system.
The power steering unit shown uses a 4-way valve which can be modeled as a variable 2-port resistor attached to a pressure source.

The relation between the pressure across the ram, \( P_m \), and the flow rate, \( Q_m \), is modulated by the relative valve displacement \( z \).
(Note that piston rod area is neglected.)

On the next page, make a clear bond graph for this system including all effects indicated on the schematic diagram.

Apply causality and state how many state equations would be needed to simulate the system.