**Controlled Exercise 2** - MEC-E5003 - Fluid Power Basics

**Case**

Load mass of cylinder 1 comes down with constant velocity. Piston of cylinder 1 causes flow rate with rotates a hydraulic motor which in turn rotates a hydraulic pump. Pump’s flow rate causes the piston of cylinder 2 to lift up. The flow rate and piston velocities of cylinders’ are restricted with an orifice.

Main question is:

* what are the pressures, flow rates and piston velocities in the system?

The cylinders are “ideal” with no leakage or friction.

**Calculate and give the results here (table) + add an extra paper with actual calculations**

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| --- | --- |
| **output variables** | **values** |
| cylinder 1, piston side pressure (*p*1) | bar |
| cylinder 2, piston side pressure (*p*2) | bar |
| motor torque (*T*) | Nm |
| pump pressure (*p*p) | bar |
| orifice flow area (*A*ori) | m2 |
| pump flow rate (*q*v2) | m3/s |
| cylinder 2 piston velocity (*v*2) | m/s |
| shaft rotational speed (*n*) | 1/s |
| motor flow rate (*q*v1)  | m3/s |
| cylinder 1 piston velocity (*v*1) | m/s |

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| --- | --- | --- |
|  | **Parameter**Gravitational constant *g*= 9.82 m/s2Load mass 1  *m*1= 5000 kgLoad mass 2  *m*2= 4000 kgPiston area 1 *A*1= 0.00312 m2Piston area 2  *A*2 = 0.00312 m2Orifice diameter *d*ori= 0.003 mFluid density  *ρ*= 870 kg/m3Flow coefficient  *C*q =0.7Motor volume (per revolution)  *V*m= 100⋅10-6m3Pump volume (per revolution)  *V*p= 80⋅10-6m3Motor’s volumetric efficiency  *η*v,m= 0.95Pump’s volumetric efficiency *η*v,p= 0.95Motor’s hydromechanical efficiency *η*hm,m= 0.9Pump’s hydromechanical efficiency *η*hm,p= 0.9 |  |