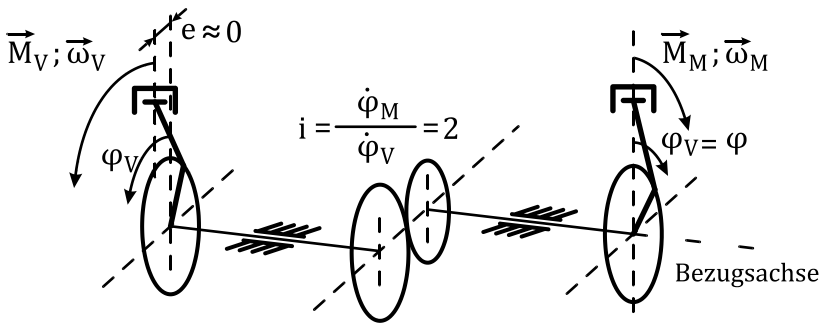
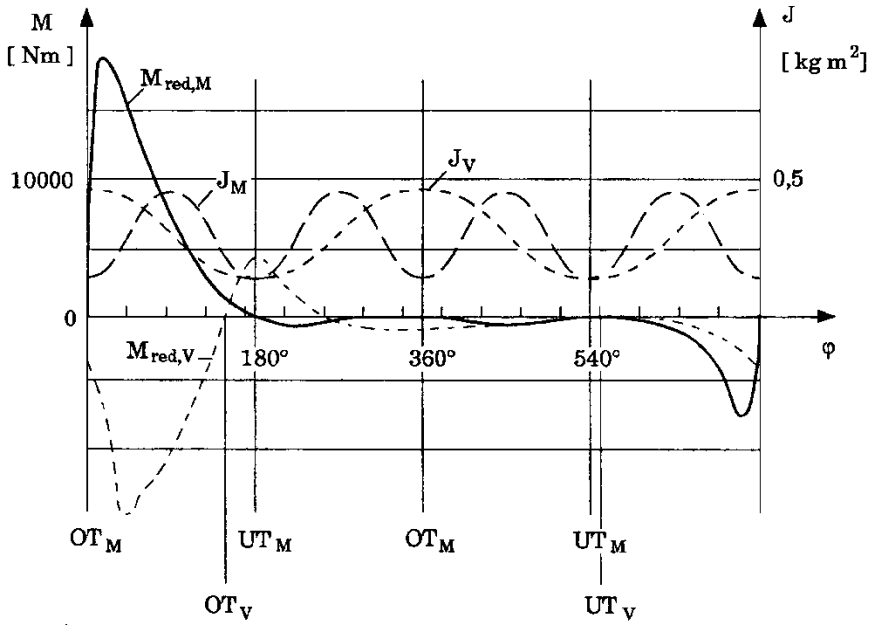
Task 14 Piston Compressor

Task

A one-cylinder piston engine drives a one-cylinder piston compressor over a transmission stage. The slider crank mechanism of the compressor has an offset, so that the intake stroke takes longer than the compression stroke. The engine should achieve the mean rotation speed 1500 min^{-1} that is 157 s^{-1} for the power 172 kW. The machine is coupled in a way, that $\varphi_M=0°$ for $\varphi_V=-80°$. From the indicator diagrams, the reduced moments for both machines are read off without the consideration of power loss.





a) Determine the total moment reduced on the motor shaft.

b) Determine the reduced mass moment of inertia. The equivalent mass moments of inertia of both connecting rods can be neglected, and also the influence of the offset in the compressor. Besides, both machines have a very small link ratio. Both machines have following mass distribution: $J_{1A_0}+m_{21}l_1^{\,2}=0{,}127\ \mathrm{kgm}^2$, $Q_3l_1^{\,2}=0{,}23\ \mathrm{kgm}^2$. Which course of the reduced mass moment of inertia will result if a flywheel with the mass moment of inertia $J_{SR}=5\ \mathrm{kgm}^2$ is attached on the motor?

c) The rotation speed is 1430 min^{-1} that is 149.7 $\mathrm{s}^{-1}$for $\varphi_M=0°$, so that the mean rotation speed is achieved. Determine the course of angular velocity and hence approximately the factor of speed fluctuation.