

Optimizing Wastewater Pumping

Challenge for Junction 2025



Task

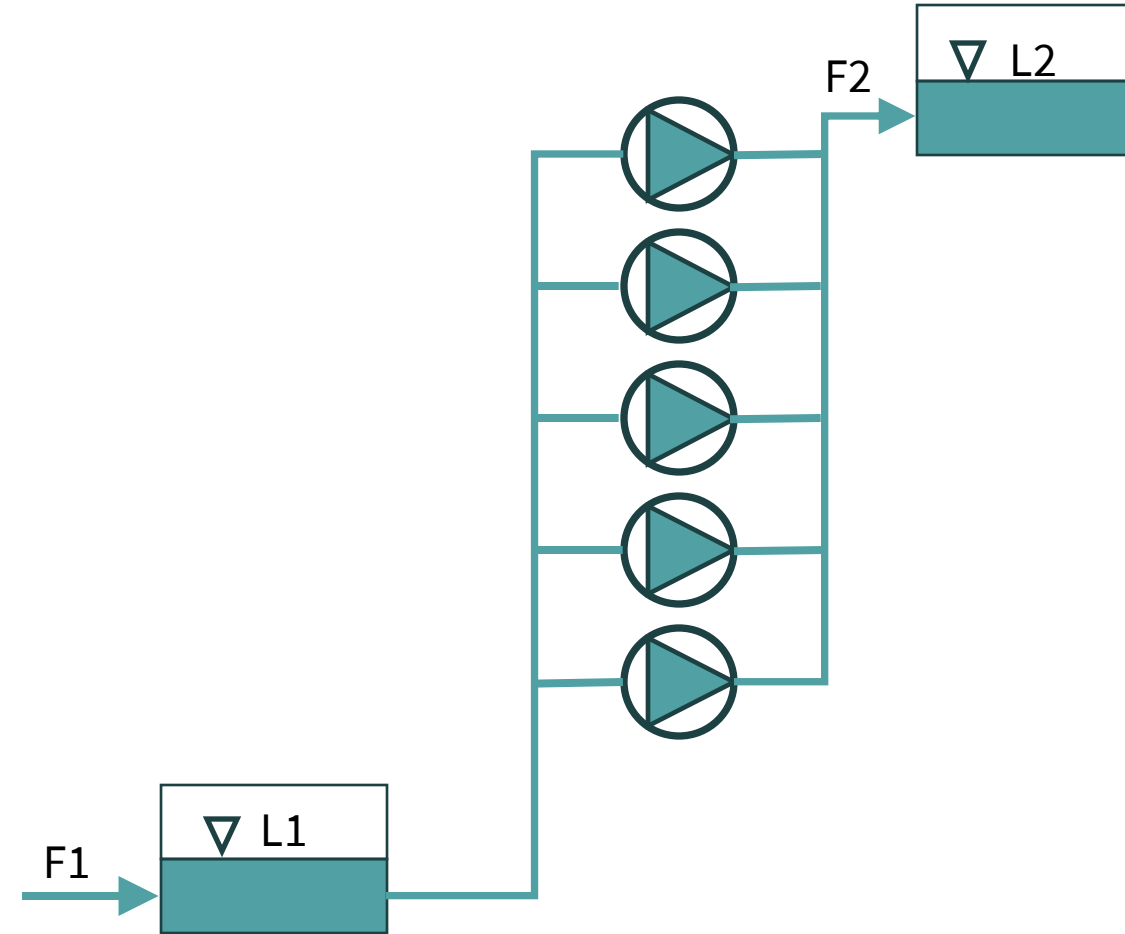
Design a pump control scheme that minimizes energy consumption while fulfilling certain boundary conditions



System Description



- Wastewater is pumped from a collection tunnel to the head of the wastewater treatment plant (WWTP)
- There are 4 pumps of capacity x and 1 pump of capacity y
- Cost of pumping is determined by energy consumption and price of electricity
- Energy requirement is determined by the pumped flowrate and the difference in elevation, aka pump head ($L2 - L1$)
- Water level $L2$ at the WWTP (pump pressure side) is constant
- Water level $L1$ in the tunnel (pump suction side) is determined by inflow from sewer network $F1$ and the flow pumped to the WWTP $F2$



Data and boundary conditions

- Data provided from a period of 14 days
 - Inflow to tunnel F1
 - L1
 - Pumped flow per pump
 - Power intake per pump
 - Electricity price
- Boundary conditions
 - Pump capacities
 - Min and max limits for L1
 - Flow to WWTP should be as close to constant as possible
 - Each pump should have approximately same amount of working hours per day
 - Tunnel must be emptied (to L1min) once in every 2 d

