

1. Dynamic Voltage and Frequency Scaling

A low-power microcontroller operates in three modes. In high-performance mode, the processor operates at a supply voltage of $V_{DD} = 1.2\text{V}$ and a frequency of 1MHz and consumes $100\mu\text{W}$ of power. Assume the resistance of the gates in the microcontroller is proportional to $1/(V_{DD} - 0.4\text{V})$.

- (a) In low-power mode, the processor operates at $V_{DD} = 0.48\text{V}$. What is the highest possible operating frequency in this mode? How much power is consumed?
- (b) In sleep mode, the process operates at a frequency of just 1kHz . What is the lowest possible operating voltage that would allow operation at this frequency? How much power is consumed?