Problem 3 – 15 points

Bart has created a new kind of transistor for Springfield Elementary’s science fair.

This transistor has three terminals, named Homer (H), Lisa (L), and Marge (M).

Bart has discovered in the lab that \( i_H \) (in mA) is related to \( v_{LM} \) (in volts) as:

\[
i_H = 3 \left( v_{LM} \right)^2 - 2 \ v_{LM} \quad \text{(mA)}
\]

Note that Bart’s transistor is completely unrelated to either a BJT or a MOSFET.

Determine the DC current (\( I_H \)) and small signal current (\( i_H(t) \)) flowing into terminal H if the total voltage between terminals L and M is:

\[
v_{LM} = 1 + 0.01 \cos \omega t
\]