Low-Voltage Circuits Using Multiple-Input Floating-Gate MOS Transistors

Bradley A. Minch

Mixed Analog-Digital VLSI Circuits and Systems Lab
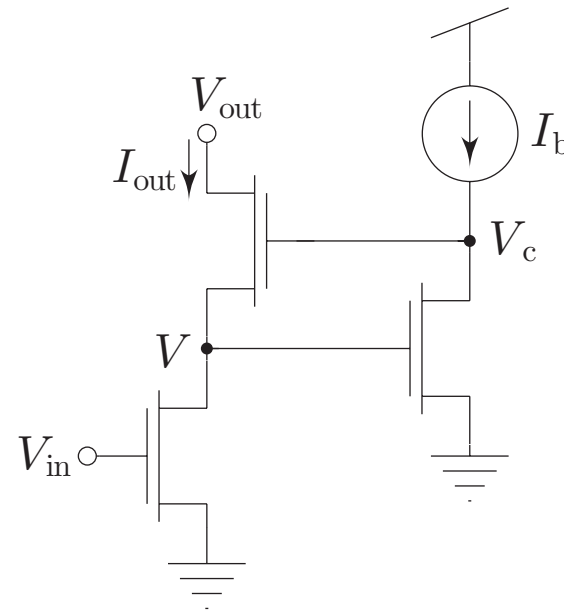Cornell University
Ithaca, NY 14853–5401

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In Search of Low-Voltage Topologies: Regulated Cascode

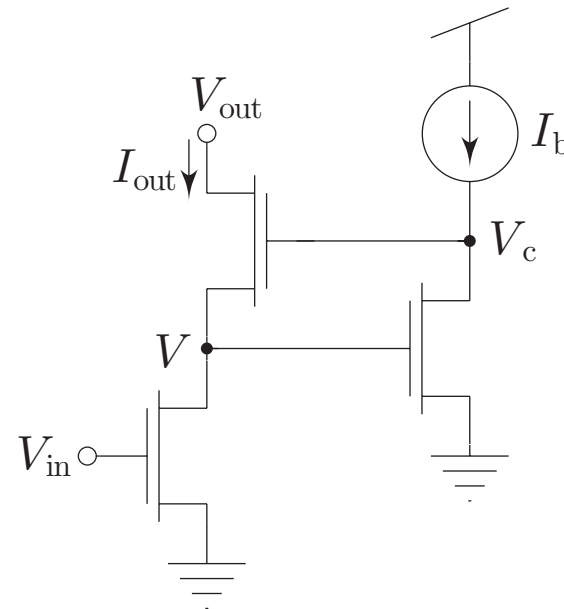- Säckinger's regulated cascode circuit has a very high incremental R_{out}.

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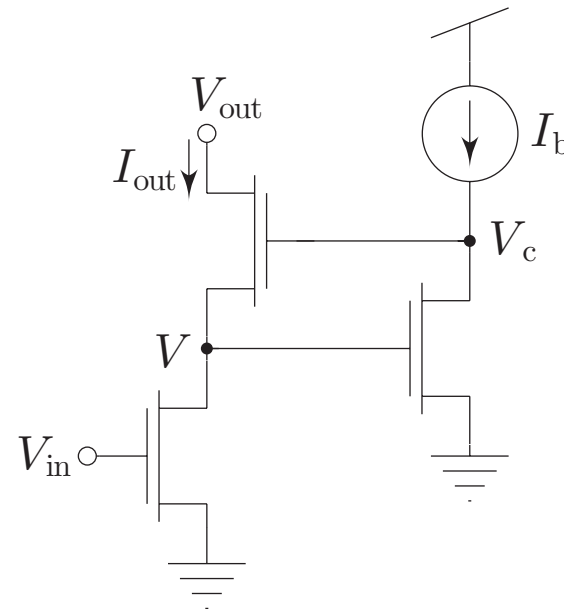
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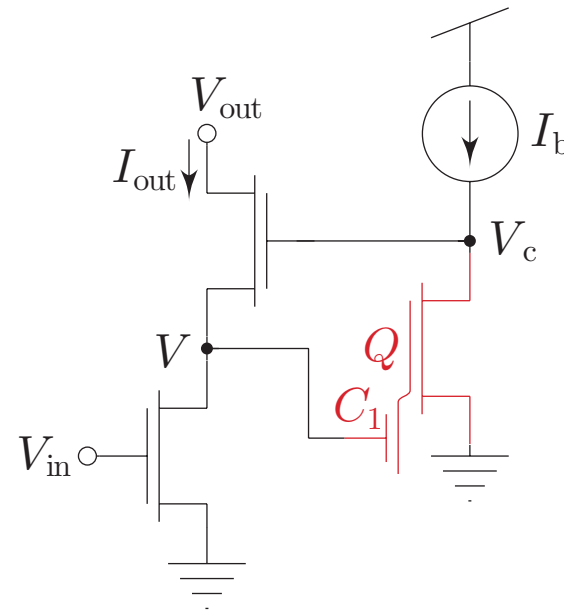
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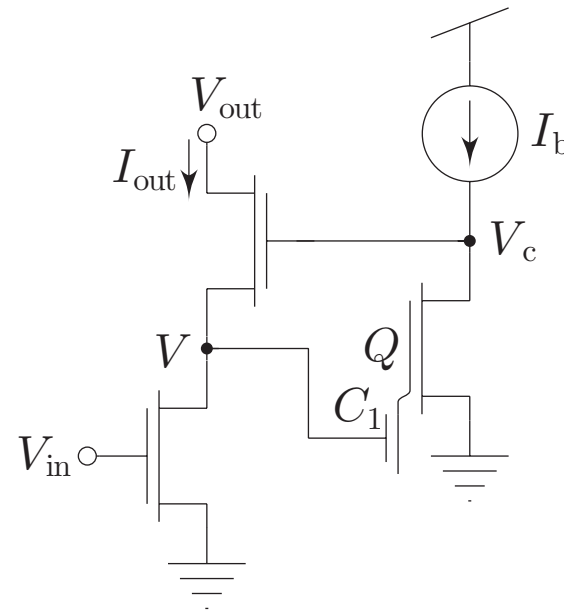
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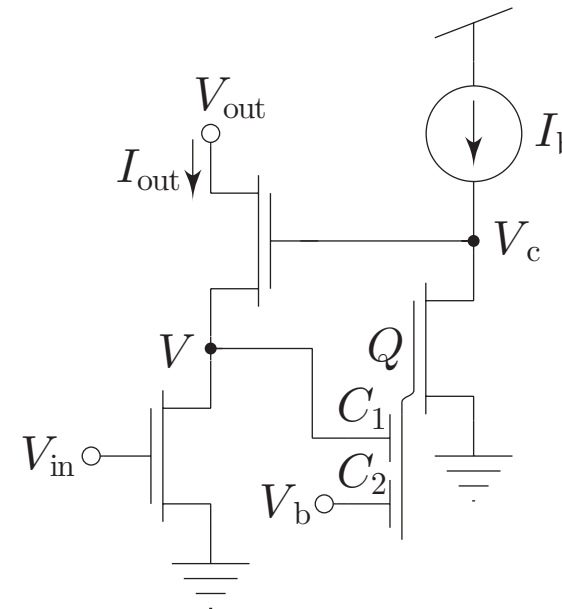
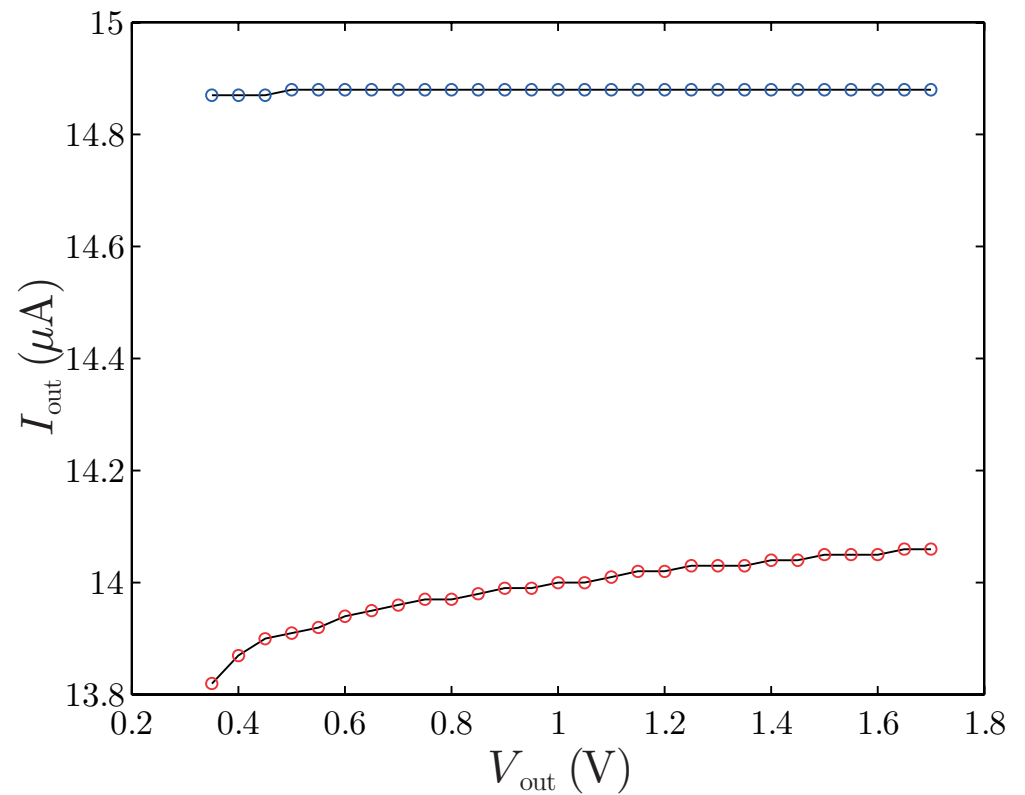- Not robust to drift in Q, or changes in I_{b} or temperature.
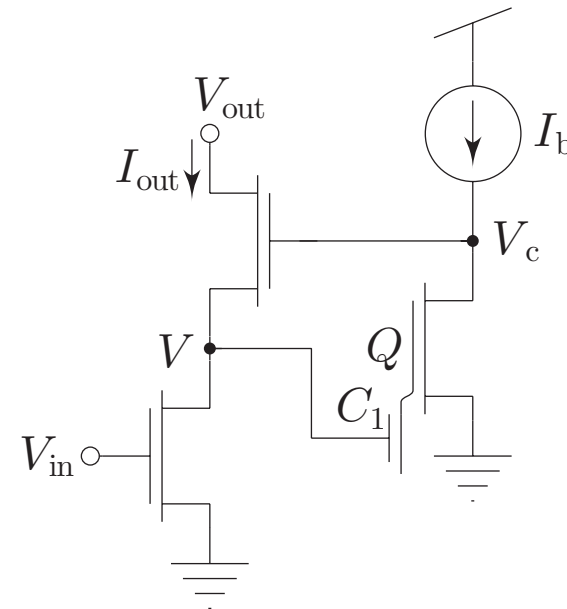
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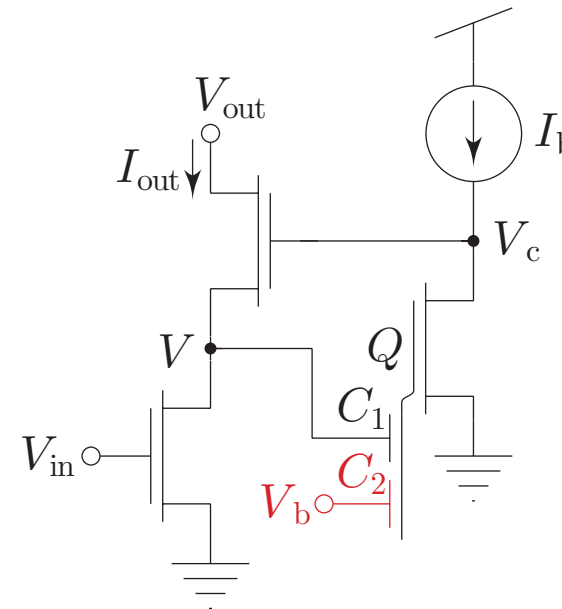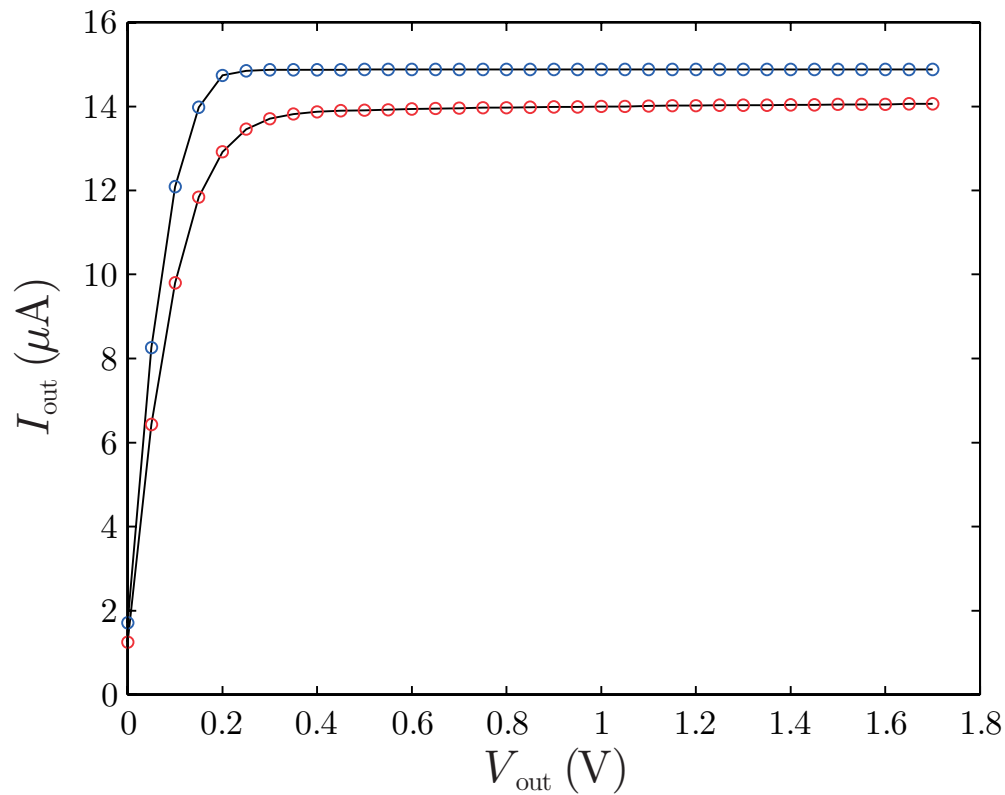
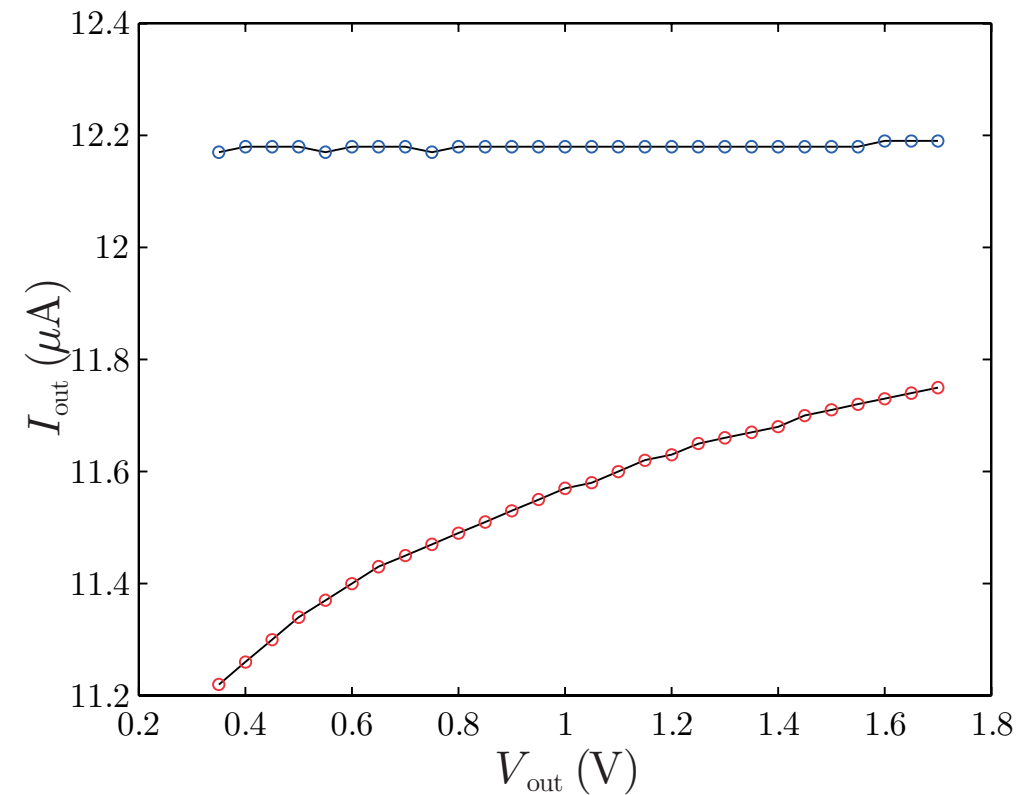# In Search of Low-Voltage Topologies: Regulated Cascode

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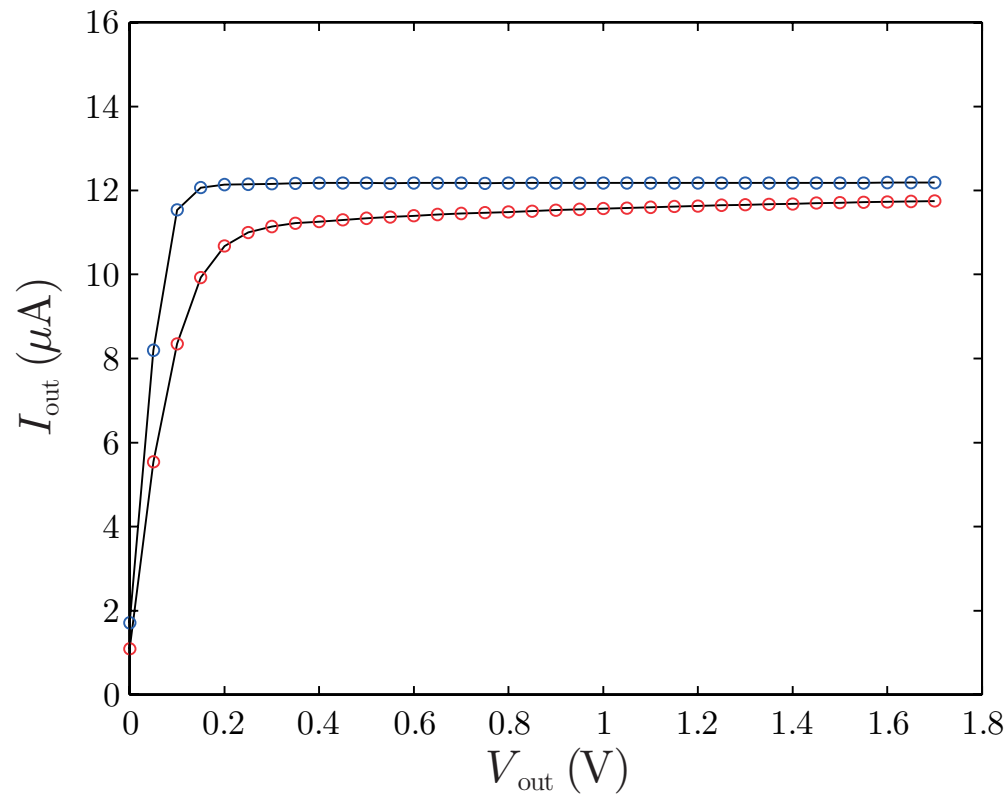
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- One V_{b} generator can be shared by multiple regulated cascodes.

Regulated CascodeExperimental Output I/V Characteristics

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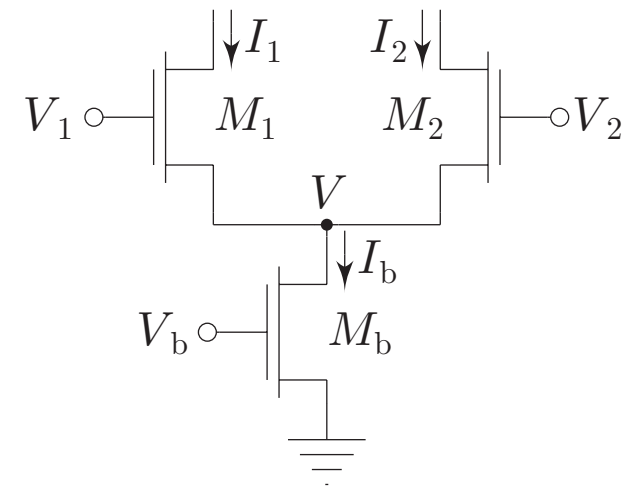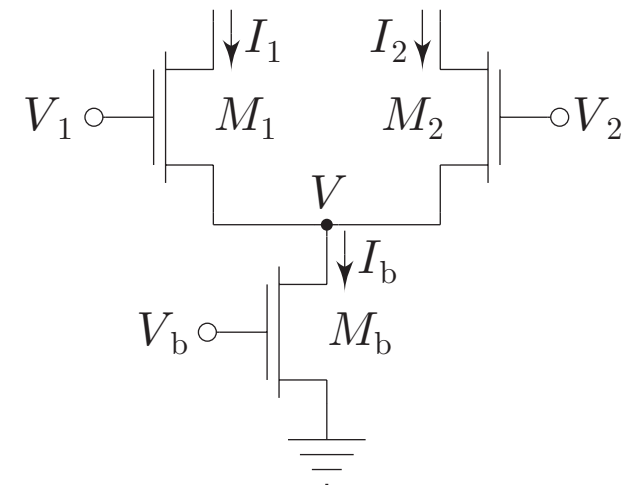# Regulated CascodeExperimental Output I/V Characteristics

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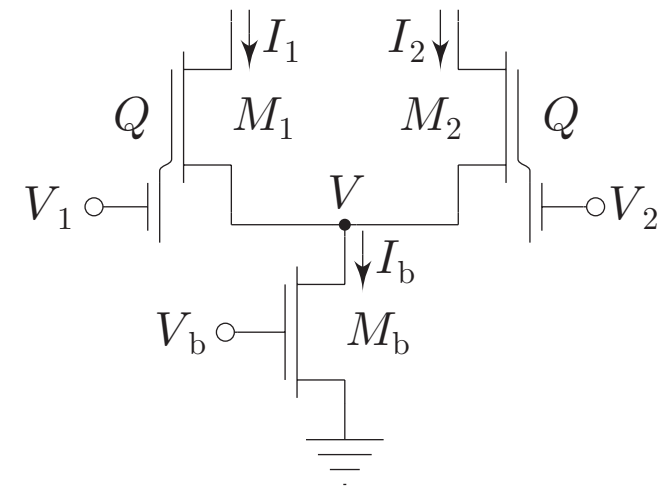- Its minimum allowable V_{cm} is about $V_{diode} + V_{sat}$.
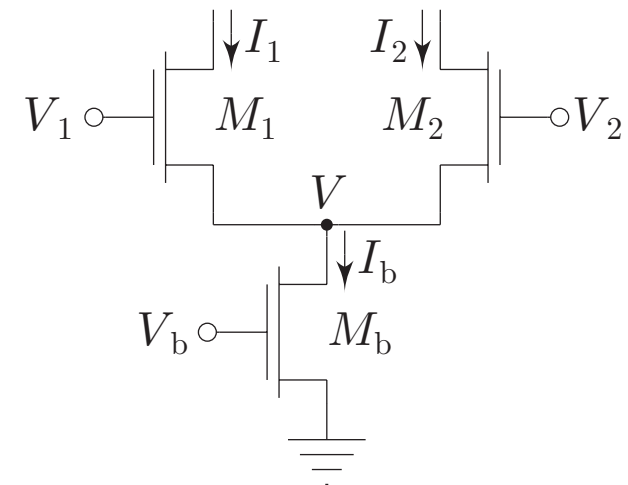
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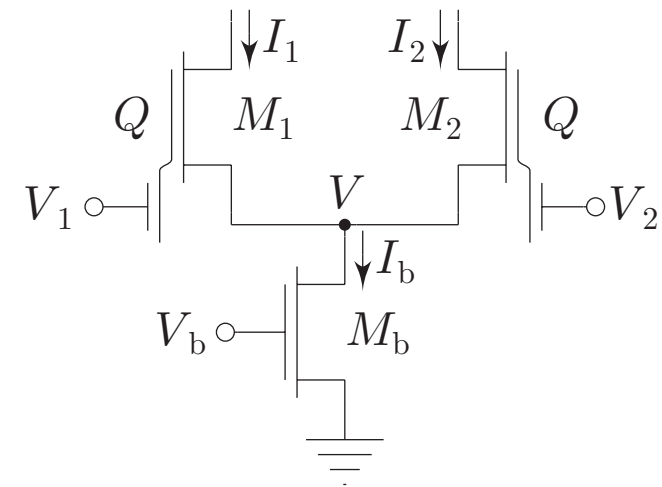- To extend the common-mode input range, we can make M_1 and M_2 FGMOS transistors.
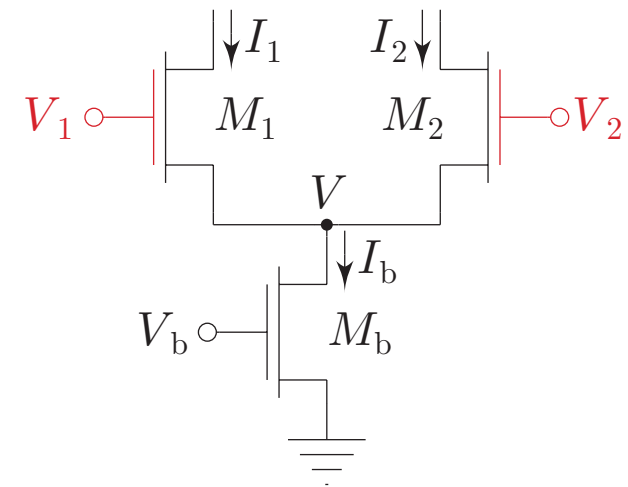
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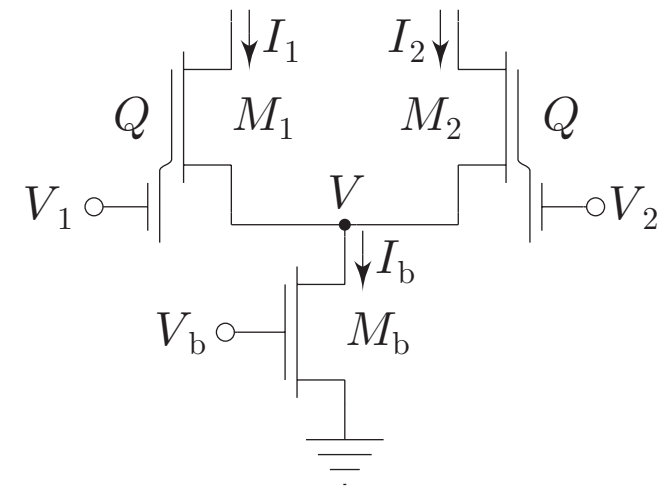
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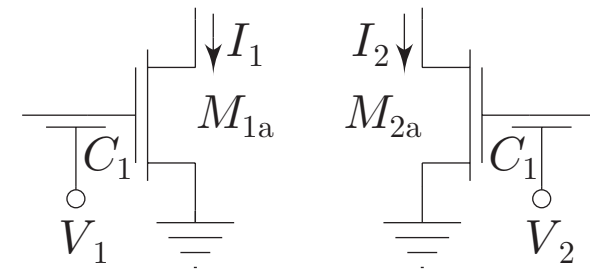- Moreover, this solution is not robust to changes in I_b.

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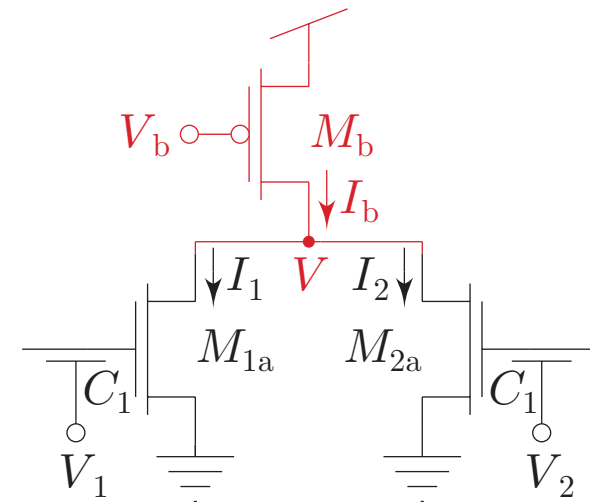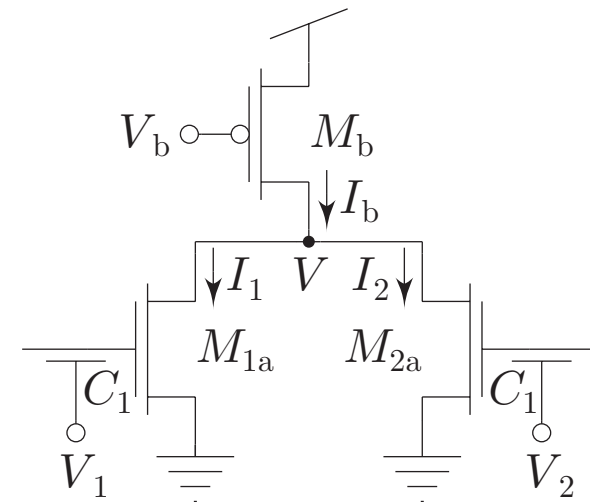- If we are going to use FGMOS transistors anyhow, can we do any better?

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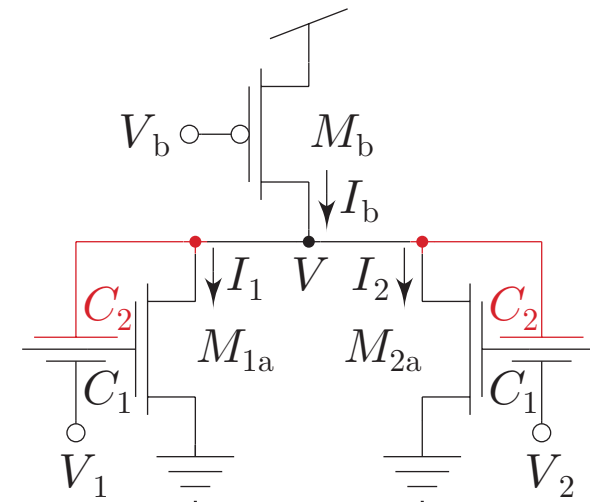
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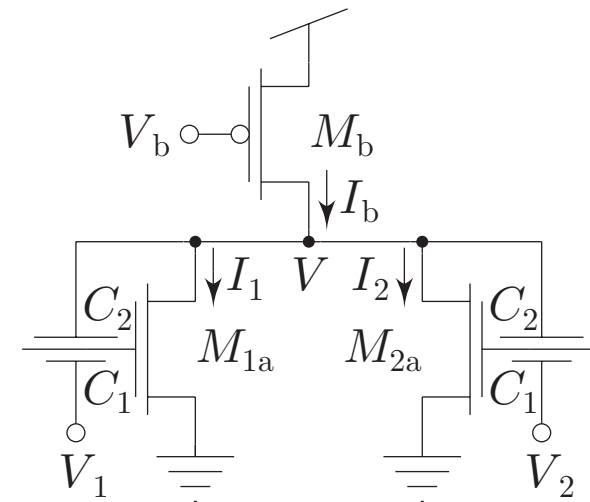- We can add I_1 and I_2 and compare $I_1 + I_2$ with I_b as shown.

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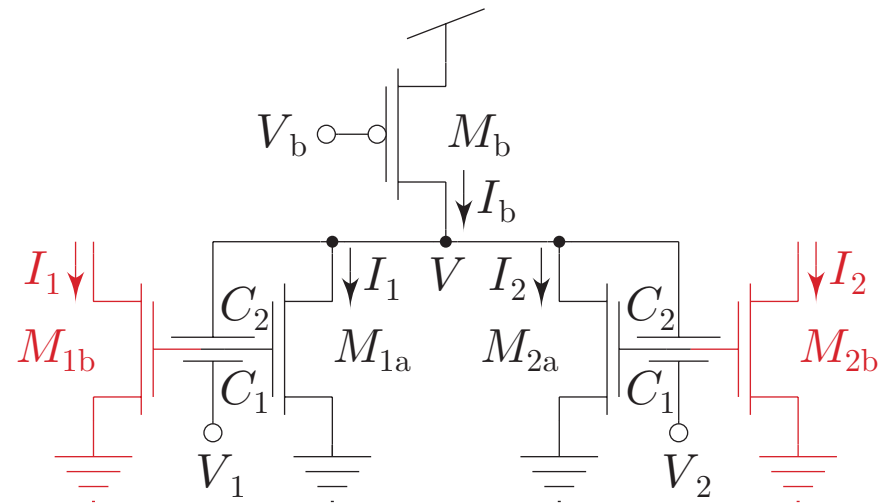- We can add I_1 and I_2 and compare $I_1 + I_2$ with I_b as shown.

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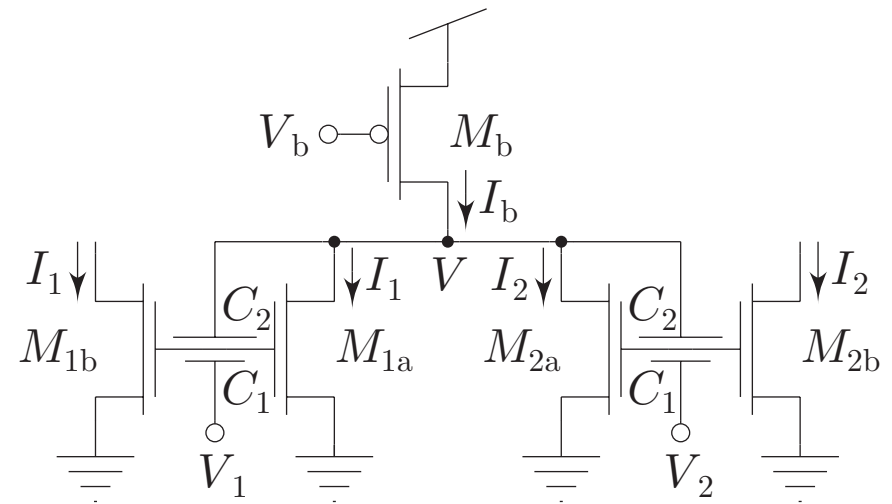- By feeding back V into both floating gates, we can regulate $I_1 + I_2$.

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- This circuit has a rail-to-rail common-mode input range, a wide output swing, and a constant G_m!
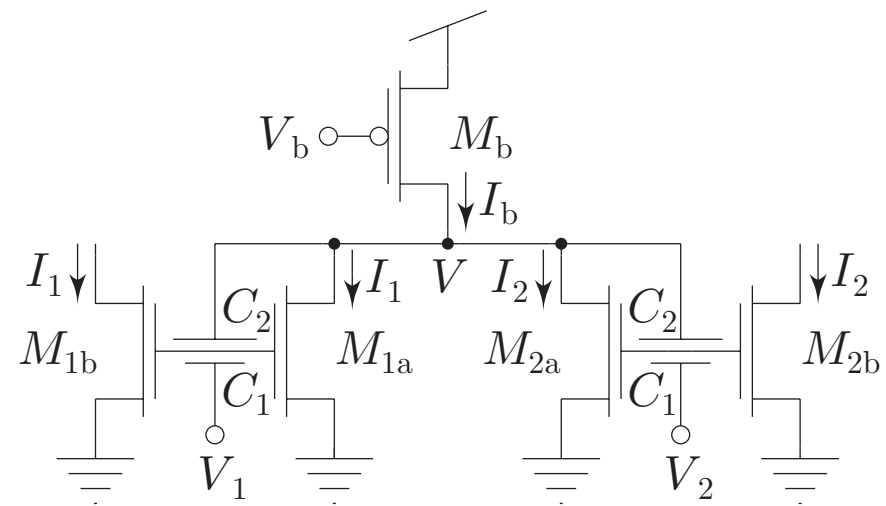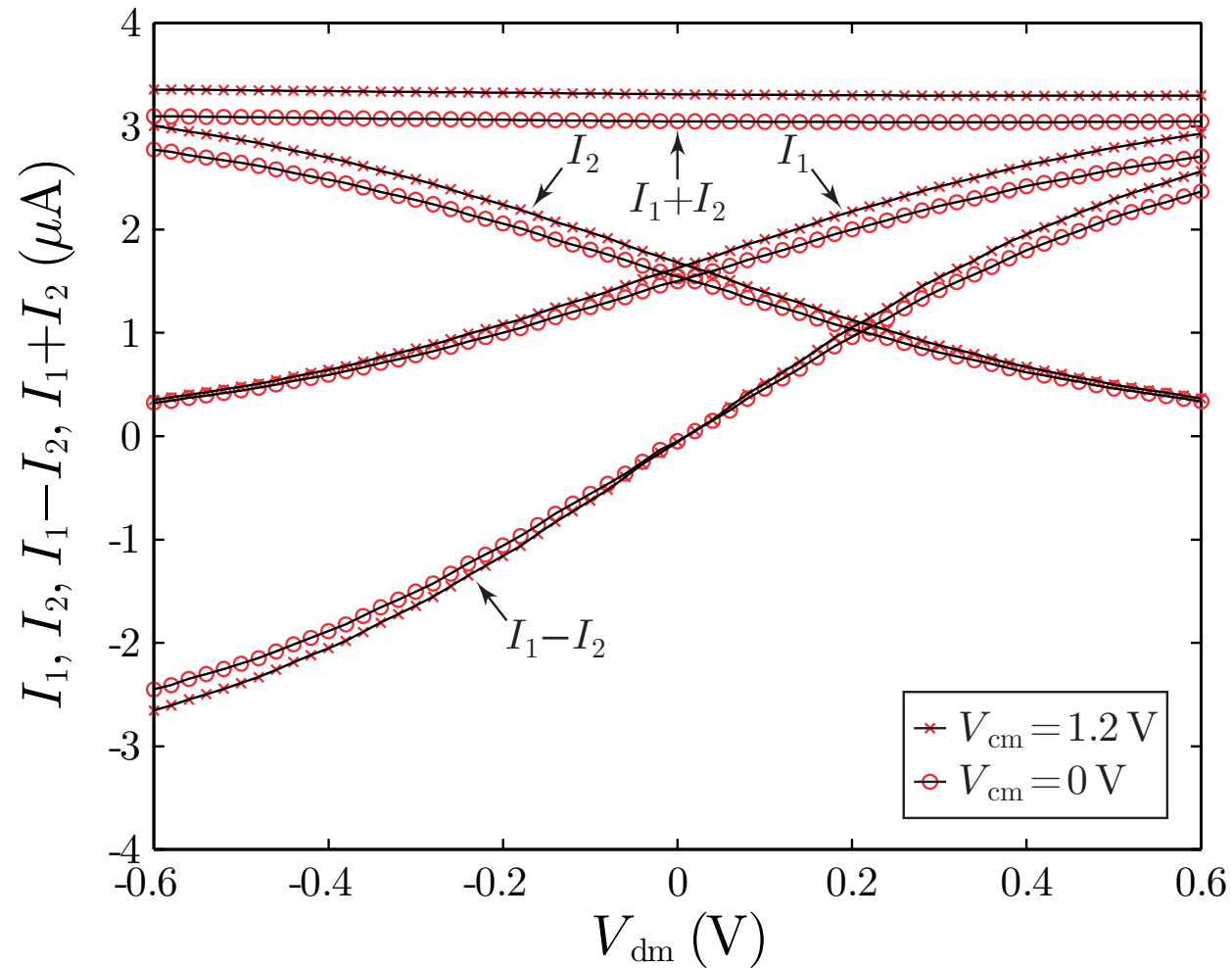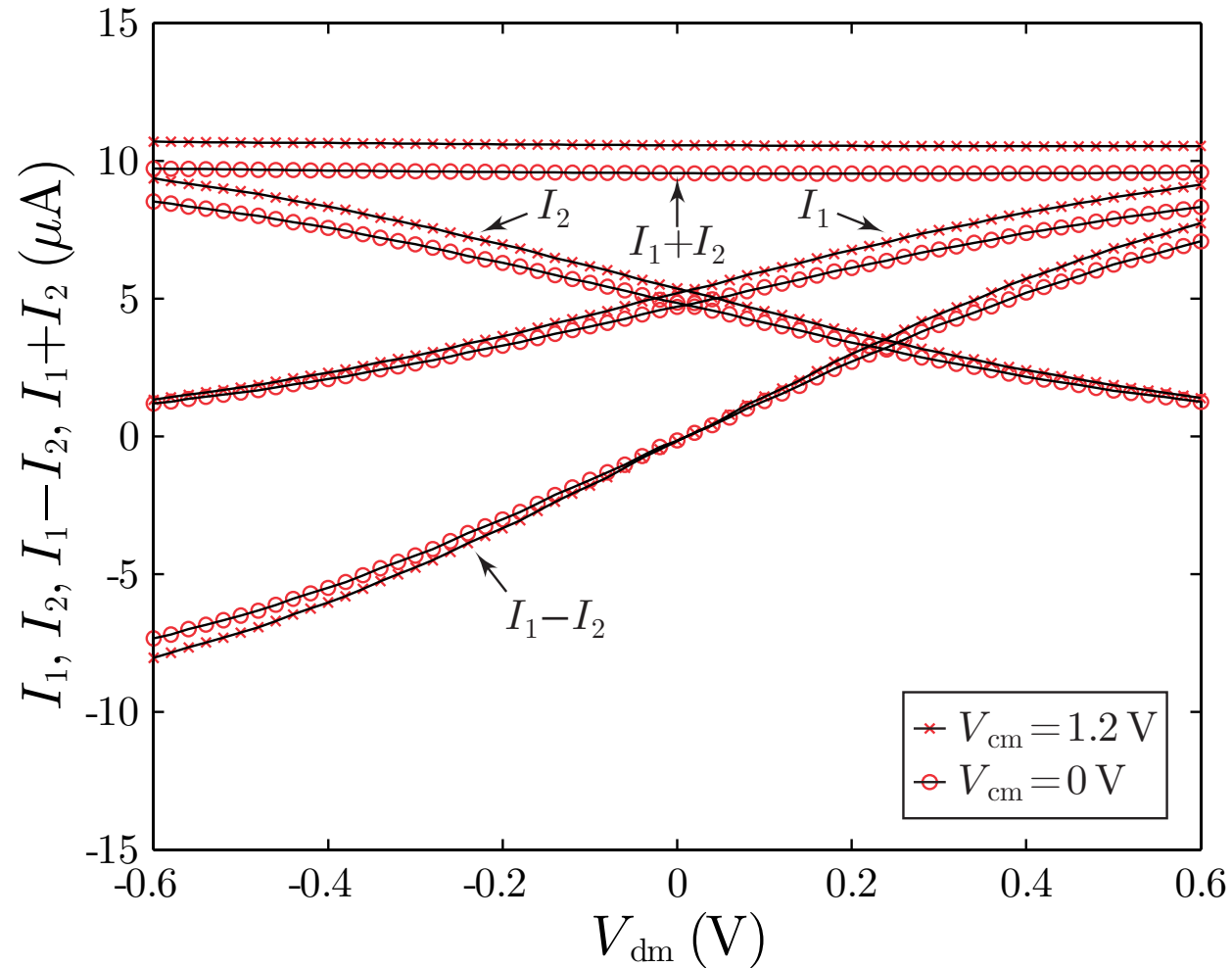
Experimental Results: I/V Characteristics $I_{\mathrm{b}} = 0.316\,\mathrm{nA}$
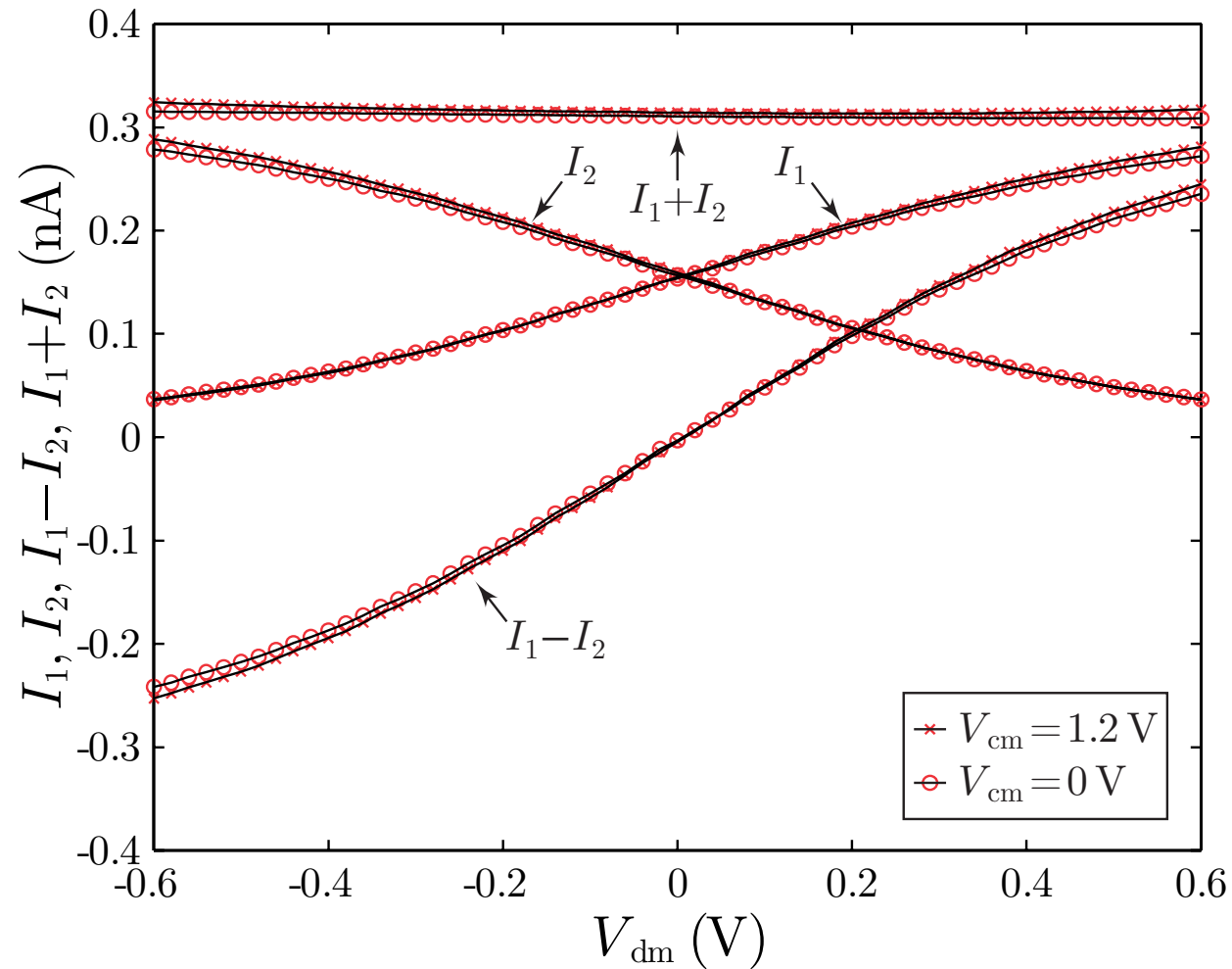
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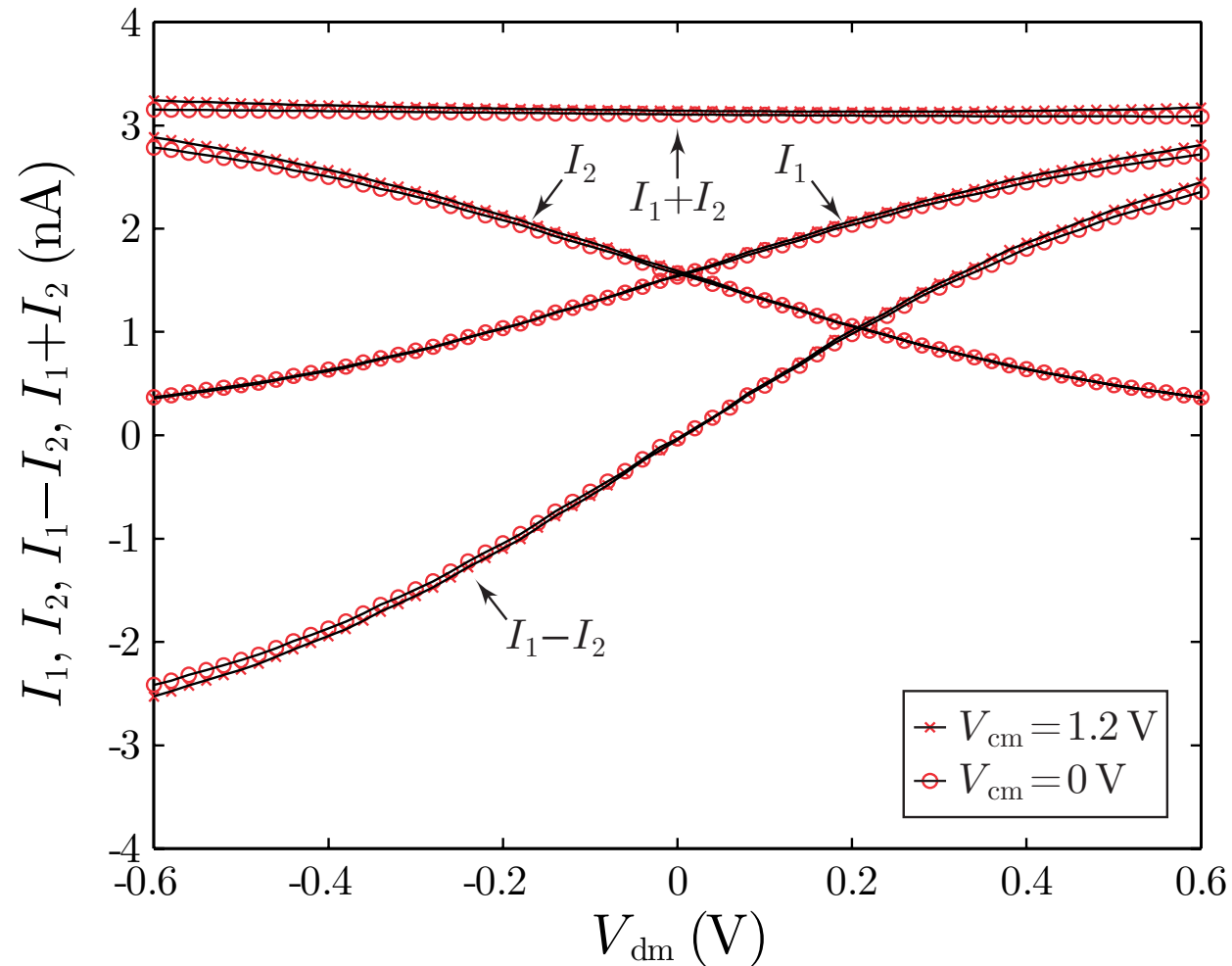
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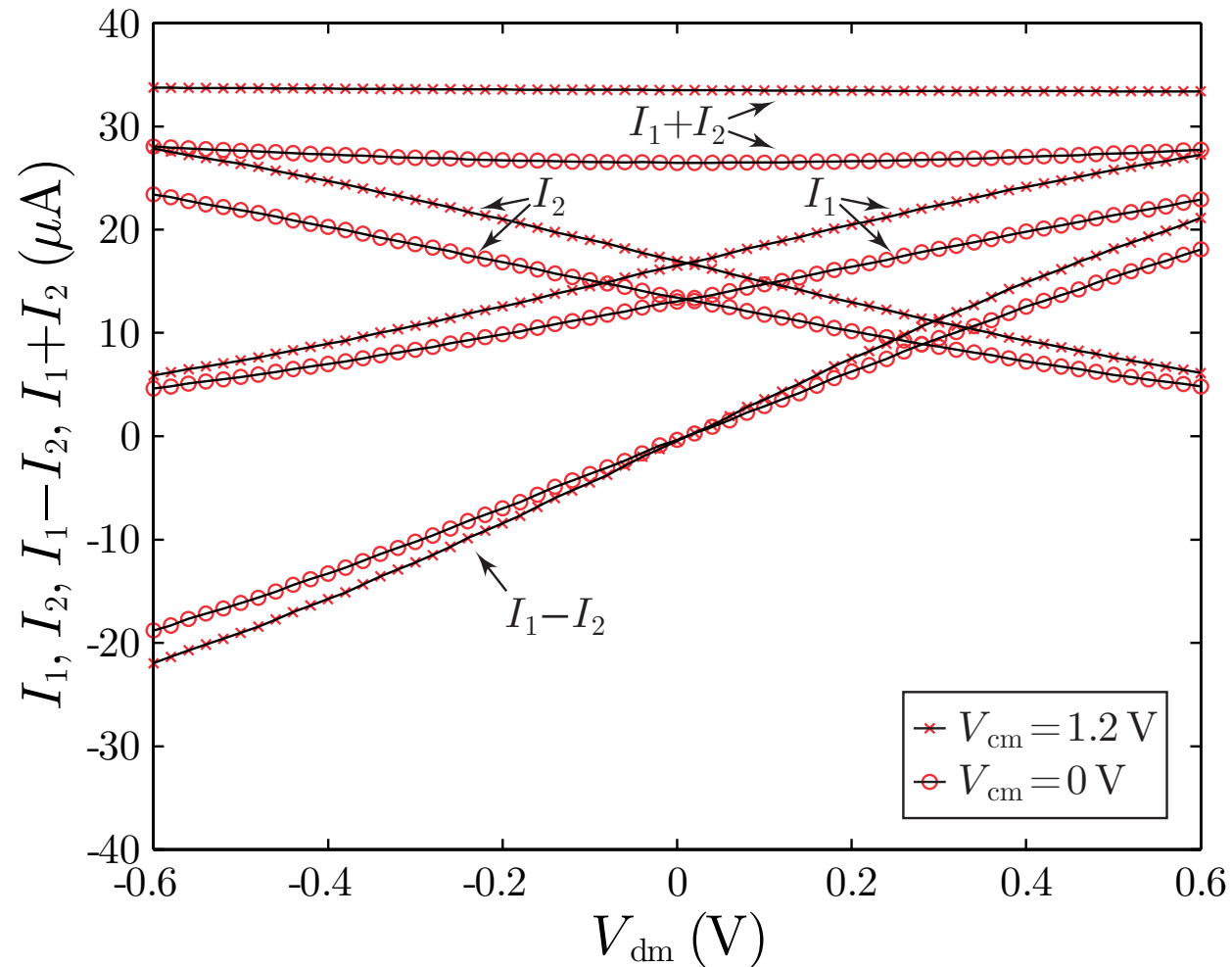
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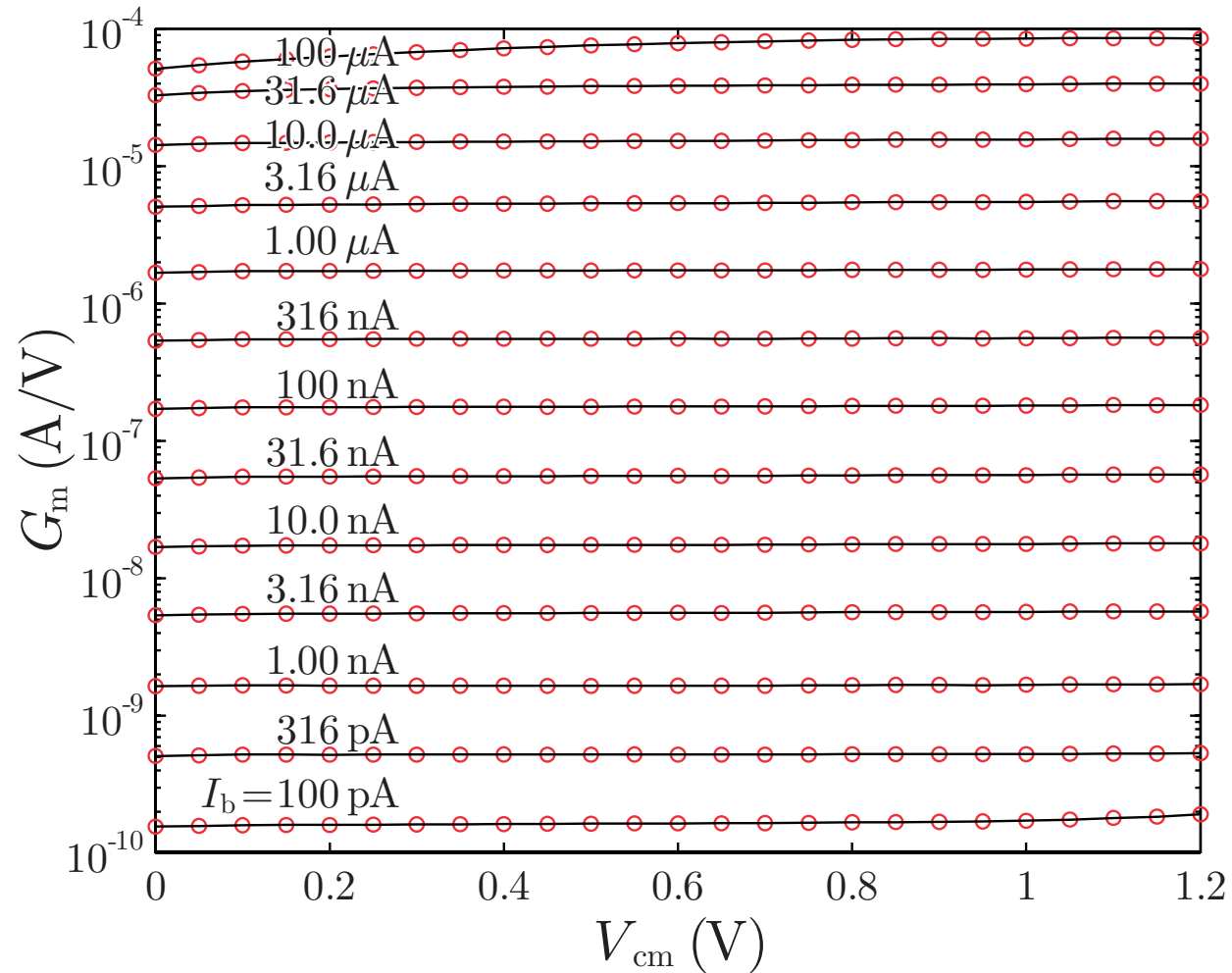
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