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Revisiting, resolving and unifying the nanochannel-microchannel electrical resistance paradigm RAMADAN ABU-RJAL, RAN ESHEL, TechnionIsrael Institute of Technology, YOAV GREEN, Ben-Gurion University of the Negev — Until recently, the accepted paradigm was that the Ohmic electrical response of nanochannel-microchannel systems is determined solely by the nanochannel while the effects of the adjacent microchannels ae negligible. Two, almost identical, models were suggested to rationalize experimental observations that appeared to confirm the paradigm. However, recent works have challenged this paradigm and showed it be incorrect, namely, the microchannels contribute in a non-negligible manner. Two newer nanochannel-microchannel models were suggested to replace the nanochannel-only models. These models were asymptotic solutions limited to either very low or very high concentrations. Here, we review these four leading models. The most popular is shown to be incorrect, while the remaining models are unified under a newly derived solution which shows remarkable correspondence to simulations and experiments. The unifying model can be used to improve the design of any nanofluidic based systems as the physics are more transparent, and the need for complicated time-consuming preliminary simulations and experiments has been eliminated.

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