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<td>Ng, Rui Qi</td>
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**Rail-to-Rail Input and Output Op Amp Using Local Charge Pump**

### Motivation

This project aims to improve the Signal-to-Noise Ratio (SNR) that has degraded over the years due to the

- Increasing demand for mixed-mode IC which introduces noise due to the clock in digital core
- Tapering of $V_{DD}$ which makes noise more dominant

### Evolution of Rail-to-Rail Input Techniques

**NMOS/PMOS Input Pair**
- Poor input swing as NMOS (PMOS) pair operate only at high (low) $V_{in}$

**Composite CMOS Input Pair**
- At mid-rail $V_{in}$, both NMOS and PMOS operate and $g_m$ doubles

**Current Steering Technique**
- $g_m$ evens out at all regions of operations

**Local Charge Pump**
- Rail-to-Rail input swing is achieved by boosting $V_{DD}$

### Proposed Idea

This project aims to boost $V_{DD}$ to $V_{DDX}$ using a local charge pump. A charge pump is also known as a **DC to DC converter** which purposes to create either a higher or lower voltage supply using **capacitors**.

### Application

Popular in modern CMOS analog intensive circuits