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An optimization technique for precise pulsatile flow generation in pressure-driven microfluidic devices[1] STEFFEN RECKTENWALD, THOMAS JOHN, CHRISTIAN WAGNER, Saarland University — Pulsatile flows are ubiquitous in nature and technology. In microfluidic devices, pulsatile or oscillatory driving of the flow enhances a broad variety of microscale operations and is also used for biomimicry in physiological studies. To study biological systems under physiologically relevant flow conditions, precise control of the time-dependent flow field is paramount. However, generating a well-defined pulsatile flow with pneumatically operated pressure pumps remains challenging and significant deviations from the desired waveform can arise. In this study, we present a method to generate an optimized pulsatile flow in pressure-driven microfluidic systems using two commercially available pressure controllers. Therefore, we derive an adapted input signal based on the amplitude response of the pumps. This adapted input results in an optimized pressure output for various pulsatile waveforms, which significantly improves the time-dependent flow of microparticles and red blood cells in microfluidic channels. Our technique does not require any hardware modifications of the commercial pumps and can be easily implemented in standard pressure-driven microfluidic setups.

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