

Abstract Submitted
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Impulse response of microresonators with a dual frequency comb probe VINCENT MICHAUD-BELLEAU, HUGO BERGERON, JEAN-RAPHAËL CARRIER, JULIEN ROY, JÉRÔME GENEST, CLAUDINE ALLEN, Université Laval, Centre d'optique photonique et laser (COPL) — Label-free microsphere were shown to be sensitive optical biosensors thanks to the very high quality factor up to $Q \approx 10^9$ of their whispering gallery modes (WGMs). Several resonances are available to probe the frequency response in polarizability, but the spectrum of WGMs for an elliptical resonator is more complicated, warranting further measures of light propagation. Our high resolution interferometric studies of a silica microresonator with a dual frequency comb provide both its impulse response in the time domain with 80 fs resolution and its transmission spectrum in the frequency domain with 125 MHz resolution, i.e. at the picometer level. We observe that a light pulse is periodically outcoupling from a $\sim 156 \mu\text{m}$ microsphere after round trips of ~ 2 ps as can be expected from the group velocity. However, the structure of the full impulse response is more rich, for example showing clusters of pulses separated by roughly ~ 50 ps. This reveals the light pulse is not outcoupling from the slightly elliptical microresonator at each round trip because its trajectory is precessing. Finally, we see that a refractive index change at the resonator surface causes a phase delay in the impulse response corresponding to the WGM frequency shifts in the spectrum

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