Zero-n band-gap in 1D periodically layered photonic superlattices[1] NICOLAE PANOIU, RICHARD OSGOOD, Columbia University, SHUANG ZHANG, STEVEN BRUECK, University of New Mexico, COLUMBIA UNIVERSITY TEAM, UNIVERSITY OF NEW MEXICO TEAM — We demonstrate that photonic superlattices consisting of a periodic distribution of alternating layers of materials with positive and negative index of refraction present a photonic band-gap at a frequency at which the spatial average of the index of refraction is zero (these stop bands are called zero-n band-gaps). We prove that these results can be generalized to two cases, namely i) a superlattice of alternating layers, one layer made of a homogeneous material with positive index of refraction and the other layer consisting of a photonic crystal, with negative index of refraction and ii) a superlattice consisting of alternating photonic crystal slabs, which, have positive and negative index of refraction. We demonstrate that, in both cases, the central frequency of the zero-n band-gap corresponds to the frequency at which the spatial average of the refractive index, taken over the unit supercell, is zero. We also show that, unlike the Bragg gaps, these zero-n band-gaps are invariant to the geometrical scaling of the superlattice or the direction of wave propagation in the superlattice.

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