Fig. 8. Histogram of the cosines of the angles between dictionary vectors for $F$ (in blue) and $\Phi$ (in red) for $\rho = 0$ (straight line), 0.9 (dotted), 0.99 (intermittent line).

It should also be noted, that the simple, stepwise implementation of the LARS algorithm yields comparable SNR values to the MP algorithm, at a rather high computational load. It then seems particularly important to use more elaborated approaches based on the $L_1$ minimization. In the next section, we will in particular evaluate a method based on the work of [32].

VI. TOWARDS IMPROVED PERFORMANCES

A. Improving the decomposition

Most of the algorithms described in the previous sections are based upon a $K$ steps iterative or greedy process, in which at step $k$ a new vector is appended to a subspace defined at step $k - 1$. In this way a $K$-dimensional subspace is progressively created.

Such greedy algorithms may be far from optimality and this explains the interest for better algorithms (i.e. algorithms that would lead to a better subspace) even if they are at the cost of increased computational complexity. For example, in the ITU G.729 speech coder, 4 vectors are selected in 4 nested loops [20]. It is not a full-search algorithm (there are $2^{17}$ combinations of 4 vectors in this coder), because the innermost loop is skipped in most cases. It is, however, much more complex than the algorithms described in the previous sections. The Backward OOMP algorithm introduced by Andrle et al. is a less complex solution than the nested loop approach [33]. The main idea of this algorithm is to find a $K' > K$ dimensional subspace (by using the OOMP algorithm) and to iteratively reduce the dimension of the subspace until