Predictive Quantization for MIMO-OFDM SVD Precoders using Reservoir Computing Framework

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***Abstract*—Precoding matrices obtained via SVD[1] of the MIMO channel matrix can be utilized at the transmitter for optimum power allocation and lower BER[2] transmissions. However, a key step enabling this improved performance is the feedback of these precoders to the transmitter from the receiver. Considering the limited bit budget for such CSI[3] feedback, the precoders need to be quantized with single digit bits. For a $N_T \times N_R$[4] MIMO system, this amounts to quantizing a $N_T \times N_R$ complex valued matrix. This odious task is helped by the presence of an underlying manifold structure, and temporal/frequency correlations in the precoders. In this work, we introduce a reservoir computing framework for the task of prediction of new precoders upon observation of past such precoders, by utilizing temporal correlations. This is a departure from existing methods which exploit the non linear geometry endowed by the manifold structure to perform the same. Alternately, the non-linear relation is captured in our work via the dynamical reservoir state via the training process of the reservoir. Simulations reveal reduced quantization error, which results in lower BER as well as improved achievable rate, as compared to previous work.**

I. Introduction
II. System Model
III. Reservoir model for Predictive Quantization
IV. Simulation Results
V. Conclusions
References

[1] Singular Value Decomposition [2] Bit Error Rate [3] Channel State Information [4] $N_T(R)$: Number of Transmit (Receive) Antennas