Robust Automatic Modulation Classification and Blind Equalization
Barathram Ramkumar, Tamal Bose and Ratchaneekorn Thamvichai

Proposed System

Cumulants Based AMC
Normalized fourth order cumulants are used for classification. Fourth order cumulants can be written in three ways
\[ C_n = \text{cum} \{ y(n), y(n), y(n), y(n) \} \]
\[ C_n = \text{cum} \{ y(n), y(n), y(n), y'(n) \} \]
\[ C_n = \text{cum} \{ y(n), y(n), y'(n), y'(n) \} \]

Effect of Multipath
\[ x(i) = H(z^{-1})w(i) \]
\[ x(i) : \text{Received Signal} \]
\[ H(z^{-1}) = 1 + \theta_1 z^{-1} + \theta_2 z^{-2} + \ldots + \theta_{L-1} z^{-(L-1)} \]
\[ w(i) : \text{Transmitted Signal} \]
The cumulants of a received signal subjected to multipath fading is given by
\[ C_{4k} = \text{cum} \{ w, x, y, z \} = E(wxyz) - E(wx)E(yz) - E(wx)E(yx) - E(xz)E(yw) \]

Adapting the predictor
The polynomials \( R(z^{-1}) \) and \( D(z^{-1}) \) are adapted by minimizing the one step ahead prediction error.
\[ J_2 = E([x(i+1) - y(i+1)]^2) \]
The above cost function is minimum when
\[ D(z^{-1}) = H(z^{-1}) \]
\[ (R(z^{-1}) + S(z^{-1})B(z^{-1})) = zH(z^{-1}) - 1. \]

Adapting B(z^{-1})
The polynomial \( B(z^{-1}) \) is adapted by minimizing the cost function related to the performance of the AMC.

AMC Decision Making
The AMC decision is made by fusing the two cumulant values i.e.,
\[ p_1 = \frac{1}{\beta} |C_{401}| \]
\[ p_2 = |C_{402}| \]
\[ p_1 = \max(p_1, p_2) \]

Simulation Results