

Robust Modified MMSE Estimator for Comb-Type Channel Estimation in OFDM Systems

Latif Ullah Khan*, M. Inayatullah Babar*, Zeeshan Sabir *

*University of Engineering & Technology, Peshawar, Pakistan

{latifullahkhan, babar , zeeshansabir}@nwfpuet.edu.pk

Abstract— Orthogonal frequency division multiplexing (OFDM) is a key technique for wireless communication because of its robustness to narrow band interference, frequency selective fading and spectral efficiency. Channel estimation and equalization in OFDM is necessary in order to nullify the effect of impairments induced by the frequency selective fading channel. In this paper, we have used frequency domain comb-type pilot assisted channel estimation. Modified Minimum Mean Square Error (MMSE) estimator is considered for estimation of the channel at pilot subcarriers. The performance and complexity comparison is made between the modified MMSE and MMSE estimator for fast fading Rayleigh channel. Linear, Low Pass and spline cubic interpolation techniques have been used with the MMSE estimator. The effect of increase in number of channel taps on the performance of both estimators is studied. Simulation results reveal that the performance of the modified MMSE estimator remains stable with an increase in channel taps, however the performance of the MMSE estimator degrades significantly with an increase in channel taps.

Keyword— OFDM; MMSE estimator; linear interpolation; spline cubic interpolation; low pass interpolation



Latif Ullah Khan was born in Bannu, Pakistan in 1989. He received his B.Sc degree in Electrical Engineering from University of Engineering & Technology (UET), Peshawar, Pakistan in 2012. He has played an active role in the project titled "A secure and intelligent transportation system using wireless sensors for congestion control". He is currently working as Research Assistant at UET Peshawar in the project "Development of a Multi-Standard Signal Processing API for SDR Applications" funded by National ICT R&D, Ministry of Information Technology Pakistan. He has a number of publications in international conferences of repute. His research interests include OFDM, Channel estimation/ Equalization of wireless channels; Channel coding, Software Defined Radio and Routing Protocols in Wireless Mobile Adhoc networks (MANETS).



M. Inayatullah Babar was born in D. I. Khan, Pakistan in 1975. He received his B.Sc Degree in Electrical Engineering from University of Engineering and Technology(UET), Peshawar, Pakistan in 1997. He completed his Masters and Doctorate Degree in 2001 and 2005 respectively from School of Engineering, George Washington University, Washington DC USA. Being a throughout topper in all his academia including four years of Bachelors Engineering, he was awarded with "Aizaz-E-Sabqat" in 2000, one of the most prestigious Govt. award in Pakistan. He also received University Gold Medal as Best Graduate and Siemens Gold Medal as Best Engineering Graduate from the Province in Year 1998. Due to his extraordinary research contributions in the field of Mobile Adhoc Networks during Doctorate studies, he was awarded "Youngest Researcher Award" from MCOS Foundation in Washington DC in 2003.

Dr. Muhammad Inayatullah Babar has more than 40 Publications in reputable Engineering Conferences and Journals. He is a member of IEEE USA and ACM USA and has the honour to chair a conference Session in International ACM Conference in USA in Year 2004. He has taught a number of Telecommunications Engineering Courses at Graduate Level in School of Engineering, Stanford University, Virginia USA. Currently, he is working as a Chairman in Deptt. Of Electrical Engineering, University of Engg. And Tech.

Peshawar, Pakistan. Alongwith this he is also the Chairman of Computer Science and Information Technology Deptt. in the same University. He is also the Project Director of Information Service Centre, UET Peshawar and Director Postgraduate Studies, UET Peshawar.



Zeeshan Sabir was born in Peshawar, Pakistan in 1980. He received his B.Sc Degree in Electrical Engineering from University of Engineering and Technology(UET), Peshawar, Pakistan in 2004 and M.S Degree in Telecomm. Engg. from National University of Sciences and Technology (NUST) Rawalpindi, Pakistan in 2010. He rejoined UET Peshawar, Pakistan since 2010 for pursuing his Ph.D studies in Telecomm. Engg. after winning a National scholarship, sponsored by Higher Education Commission Pakistan, scoring 99.35 percentile marks and getting 2nd position in the country. From 2004 to 2008 he has worked with two National R&D Organizations involved in providing technical support to different Govt. funded Engg. Projects in the country. His research interests include Wireless Mobile Adhoc Networks (MANETS), OFDM, Turbo Codes, Channel Estimation/Equalization of Wireless channels, Queuing Theory in MANETS, Error Correction etc. He has a number of publications in international journals and conferences of International repute. He is writer of a book/monograph in the field of Telecomm. Engg. Title of the book is "OFDM, Turbo Codes and Improved Channel

Estimation-A magical Combination". The book bears ISBN # 9783639326505 and is published by VDM Verilog Publishers, Germany in Jan, 2011. He has the honour to present his Research Papers in a number of reputable international conferences world-wide.