

# An Adaptive Cooperative Protocol for Multi-Hop Wireless Networks

Smich Butcharoen, Chaiyod Pirak

The Sirindhorn International Thai-German Graduate School of Engineering (TGGS),  
King Mongkut's University of Technology North Bangkok, Thailand  
smichb@tot.co.th, chaiyod.p.ce@tggs-bangkok.org

**Abstract**— A Multi-hop relay communication system has gained tremendous attention recently as it reduces capital investment for expansion of coverage area. In this work, an adaptive cooperative decode-and-forward (DF) protocol was developed to enhance the performance of the system. In particular, a 'best destination relay selection' approach (BDRS) was proposed to achieve high diversity gain. The approach starts by selecting a destination node with the maximum channel gain first, and then selecting a relay node with the minimum outage probability afterwards. Closed-form expressions for the outage probability, which is a measure of system performance, were derived. Their validity was checked by comparing the calculated results with the simulated results from MATLAB software. Both results were found to be almost identical. Simulated outage probability of the proposed protocol was also found to be many folds lower than those of conventional and modified multi-hop communication protocols. Lastly, an optimum power allocation scheme was applied to further minimize outage probability.

**Keyword**— Multi-Hop; Relay selection; Routing strategy; Cooperative communication; Power allocation



**Smich Butcharoen** received his Bachelor degree in telecommunication engineering from Suranaree University of Technology, Nakhonratchasima, Thailand in 1997. Master degree in information technology from King Mongkut's University of Technology North Bangkok, Thailand in 2004. Currently, he is a Ph.D. candidate in wireless communication engineering of The Sirindhorn International Thai-German Graduate School of Engineering (TGGS), King Mongkut's University of Technology North Bangkok, Thailand.



**Chaiyod Pirak** received his Bachelor degree in telecommunication engineering from King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand in 2001 and Ph.D. degree from University of Maryland, College Park, MD, USA in 2005. He is holding a lecturer position at communication engineering department of TGGS. His research interests include the area of wireless communication.