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Power Allocation in Multibeam Satellites Based on Particle Swarm Optimization

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Abstract— In this paper, a power allocation in multibeam satellite (MBS) communication based on heuristic particle swarm optimization (PSO) is proposed. The PSO algorithm is evocated to solve the problem of power allocation in the multiple narrow spotbeams aiming to provide the minimum signal-to-noise plus interference ratio (SNIR) required by Earth station users to establish reliable communication. In the developed model it is considered the multibeam interference and the different channel conditions of each beam by rain attenuation. The numerical results have been generated taking into account different sky situations, including clear and rainy scenarios; such results have revealed the viability and accuracy of the PSO algorithm deployment in solving the power allocation problem. In addition, with the proposed scheme it is observed the decrement of transmitted power for non-rainy beams with guarantee of the minimum SNIR at the the Earth receivers input, while increase the power availability to the rainy beams; as a consequence, the overall energy efficiency of the MBS system has been improved substantially. Moreover, the convergence of the proposed heuristic PSO-based algorithm is discussed while such heuristic approach comes with computational complexity reduction when compared with others efficient power allocation schemes.

Index Terms—Multibeam satellite (MBS) communication, PSO, power allocation, computational complexity, non-convex optimization.

I. INTRODUCTION

Satellite communications are a vital part of the communications systems around the world since they provide services which are not, or only to a lesser extent, found in terrestrial networks. Such satellite networks possess three essential properties: a) broadcasting, connecting people across continents; b) a wide bandwidth available; c) rapid