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OUTAGE PERFORMANCE OF MULTI-BRANCH SC RECEIVER OVER CORRELATED WEIBULL CHANNEL IN THE PRESENCE OF CORRELATED RAYLEIGH CO-CHANNEL INTERFERENCE

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Abstract. *The aim of this paper is to consider the performance of wireless communication system with signal-to interference ratio (SIR) based multiple-branches selection combining (SC) receiver. The proposed system operates over correlated Weibull multipath environment, in the presence of co-channel interference (CCI) subjected to correlated Rayleigh multipath fading. SC diversity technique is used to reduce the effects of multipath fading and CCI on the system performance. Infinite-series expression for outage probability (OP) in terms of Meijer G functions is derived. Further, numerical results are graphically presented and discussed to show the influence of fading parameters on outage probability.*

Key words: *outage probability, correlated multipath fading, co-channel interference*

1. INTRODUCTION

Performance analysis of wireless communication system has become crucial in recent years due to the rapid growth of mobile communication services and emerging broadband mobile internet access services. The performance of communication wireless system is governed by the wireless channel environment. Propagation of radio waves is mainly affected by reflection, diffraction and scattering, causing the phenomena known as multipath fading. In cellular mobile systems appearances of short term fading and co-channel interference (CCI) are usually considered to be the main limitations of system performances and capacity [1].

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CCI is defined as the signal, with the same carrier frequency like the information bearing signal [2]. Appearance of signals from two or more channels, operating at the same frequency, often is resulting in harmful effect to system performances, known as CCI. In cellular mobile radio systems, CCI power is sufficiently higher then Gaussian noise power, another well-known obstacle, so thermal noise effects on communication can be ignored. It is important to determine how CCI, as a major drawback, affects major performance criterions of each wireless communication system. Short-term fading also heavily influences wireless transmission. The realistic scenario can be when desired signal is exposed to the influence of multipath fading in the nonlinear environment, while CCI signals are exposed also to multipath fading but in the linear environment [3, 4]. Weibull multipath fading can be used in order to describe small-scale signal envelope in the nonlinear environment, caused by spatially correlated surfaces. The assumption of homogeneous scattering field is certainly approximation, taken into consideration by other well-known distributions such as Rice, Nakagami-*m*, Rayleigh and *k*-*μ*. Rayleigh distribution can be used to describe the effect of multipath fading on CCI.

There are several diversity combining techniques which can be used to reduce the effects of multipath fading and CCI [4-6]. Because of its practicality, the realization of multiple branch selection combining (SC), is most commonly applied. Performance of SC reception in fading environment with present CCI have already been considered in the literature [8-13, 16]. In [8], performance analysis of SIR based dual branch SC receiver operating over correlated Rician multipath fading environment in the presence of CCI subjected to correlated Rician multipath fading is analyzed. Derivations of OP and BER for SIR based SC receiver are given in [9], with SC input signal envelopes being modeled by Nakagami-*m* distribution. The OP of multi-branch receiver operating over interference limited correlated Weibull multipath fading environment is evaluated in [10]. Statistical characteristics of Weibull random process is investigated in [11].

In this paper, the more realistic scenario will be analyzed. The case when correlated multipath fading effects system performances in nonlinear environment is taken into consideration. Signal-to-interference ratio (SIR) based multiple-branches SC diversity reception over correlated Weibull multipath fading channels in the presence of CCI affected by correlated Rayleigh fading is observed. Infinite-series expression for outage probability of the proposed system in terms of Meijer G functions is efficiently derived.

2. CHANNEL MODEL

Wireless communication system with multi-branches SC receiver in the presence of Weibull multipath fading and Rayleigh co-channel interference is now analyzed. Desired signal is subjected to correlated identical Weibull fading. Desired signal envelopes x_1, $x_2, \ldots, x_L$ at inputs of L-branch SC receiver follow distribution [10, eq. (23)]:

$$p_{x_1x_2\ldots x_L}(x_1,x_2,\ldots,x_L)=\frac{\beta^L}{\Omega_d{}^L(1-\rho)^{L-1}}\sum_{k_1=0}^{\infty}\sum_{k_2=0}^{\infty}\cdots\sum_{k_{L-1}=0}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_d(1-\rho)}\right)^{2\sum_{i_1=1}^{L-1}k_{i_1}}\times$$
$$\times\frac{1}{\prod_{i_2=1}^{L-1}(k_{i_2}!)^2}x_1{}^{(k_1+1)\beta-1}\prod_{i_3=2}^{L-1}x_{i_3}{}^{(k_{i_3-1}+k_{i_3}+1)\beta-1}x_L{}^{(k_{L-1}+1)\beta-1}\times \tag{1}$$
$$\times\exp\left\{-\frac{1}{\Omega_d(1-\rho)}(x_1{}^{\beta}+(1+\rho)\sum_{i_4=2}^{L-1}x_{i_4}{}^{\beta}+x_L{}^{\beta})\right\},L>2.$$

where β is multipath Weibull fading severity, ρ is correlation coefficient, Ω_d is average square value of desired signal envelope and L is the number of branches at the input of SC receiver.

Interference signal envelope is affected by correlated identical Rayleigh fading, resulting in co-channel interference envelope variation. Co-channel interference envelopes at inputs of L branch SC receiver y_1, y_2,..., y_L are described by the following Rayleigh distribution [15, eq. (6.2)]:

$$p_{y_1y_2\ldots y_L}(y_1,y_2,\ldots,y_L)=\frac{2^L}{\Omega_i{}^L(1-\rho)^{L-1}}\sum_{l_1=0}^{\infty}\sum_{l_2=0}^{\infty}\cdots\sum_{l_L=0}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_i(1-\rho)}\right)^{2\sum_{j_1=1}^{L-1}l_{j_1}}\times$$
$$\times\frac{1}{\prod_{j_2=1}^{L-1}(l_{j_2}!)^2}y_1{}^{(2l_1+1)}\prod_{j_3=2}^{L-1}y_{j_3}{}^{2(l_{j_3-1}+l_{j_3})+1}y_L{}^{(2l_{L-1}+1)}\times \tag{2}$$
$$\times\exp\left\{-\frac{1}{\Omega_i(1-\rho)}(y_1{}^2+(1+\rho)\sum_{j_4=2}^{L-1}y_{j_4}{}^2+y_L{}^2)\right\},L>2.$$

where Ω_i is average squared value of co-channel interference envelope.

The ratios of desired signal envelope and interference signal envelope at inputs of SC receiver are denoted with μ_1, μ_2,…, μ_L which can be written in the following form:

$$\mu_1=\frac{x_1}{y_1},\mu_2=\frac{x_2}{y_2},\cdots,\mu_L=\frac{x_L}{y_L}. \tag{3}$$

The joint probability density function of μ_1, μ_2,…, μ_L is given by [10, eq. (8)]:

$$p_{\mu_1\mu_2\ldots\mu_L}(\mu_1\mu_2\ldots\mu_L)=\int_0^{\infty}dy_1\int_0^{\infty}dy_2\ldots\int_0^{\infty}dy_L\,y_1y_2\ldots y_L\times$$
$$\times p_{x_1x_2\ldots x_L}(\mu_1x_1,\mu_2x_2,\ldots,\mu_Lx_L)p_{y_1y_2\ldots y_L}(y_1y_2\ldots y_L)=$$
$$=\frac{\beta^L}{\Omega_d{}^L(1-\rho)^{L-1}}\frac{2^L}{\Omega_i{}^L(1-\rho)^{L-1}}\sum_{k_1}^{\infty}\sum_{k_2}^{\infty}\cdots\sum_{k_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_d(1-\rho)}\right)^{2\sum_{i_1=1}^{L-1}k_{i_1}}\times$$

$$\begin{aligned}
&\times\frac{1}{\prod_{i_2=1}^{L-1}(k_{i_2}!)^2}\sum_{l_1}^{\infty}\sum_{l_2}^{\infty}\cdots\sum_{l_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_i(1-\rho)}\right)^{2\sum_{j_1=1}^{L-1}l_{j_1}}\frac{1}{\prod_{j_2=1}^{L-1}(l_{j_2}!)^2}\mu_1^{(k_1+1)\beta-1}\times\\
&\times\prod_{i_3=2}^{L-1}\mu_{i_3}^{(k_{i_3-1}+k_{i_3}+1)\beta-1}\mu_L^{(k_{L-1}+1)\beta-1}\int_0^\infty y_1^{(k_1+1)\beta+2l_1+1}e^{-\frac{1}{\Omega_i(1-\rho)}y_1^2-\frac{1}{\Omega_d(1-\rho)}\mu_1^\beta y_1^\beta}dy_1\times\\
&\times\prod_{j_3=2}^{L-1}\left(\int_0^\infty y_{j_3}^{(k_{j3-1}+k_{j3}+1)\beta+2l_{j_3-1}+2l_{j_3}+1}e^{-\frac{(1+\rho)}{\Omega_i(1-\rho)}y_{j_3}^2-\frac{(1+\rho)}{\Omega_d(1-\rho)}\mu_{j_3}^\beta y_{j_3}^\beta}dy_{j_3}\right)\times\\
&\times\int_0^\infty y_L^{(k_{L-1}+1)\beta+2l_{L-1}+1}e^{-\frac{1}{\Omega_i(1-\rho)}y_L^2-\frac{1}{\Omega_d(1-\rho)}\mu_L^\beta y_L^\beta}dy_L,\ L>2.
\end{aligned}\tag{4}$$

By using the integral:

$$\int_0^\infty x^{p-1}e^{-x-\beta x^\gamma}dx=\frac{\lambda^p}{(\sqrt{2\pi})^{\lambda+k-2}}\sqrt{\frac{k}{\lambda}}\cdot G_{\lambda,k}^{k,\lambda}\left[\beta^k\frac{\lambda^\lambda}{k^\lambda}\middle|\begin{matrix}\frac{1-\mathrm{p}}{\lambda},\frac{2-\mathrm{p}}{\lambda},\dots,\frac{\lambda-\mathrm{p}}{\lambda}\\ 0,\quad 1/2\end{matrix}\right].\tag{5}$$

where $G[\cdot]$ is Meijer's G-function [14, eq. (9.301)], expression (4) becomes:

$$\begin{aligned}
&p_{\mu_1\mu_2\ldots\mu_L}(\mu_1\mu_2\ldots\mu_L)=\frac{\beta^L}{\Omega_d{}^L(1-\rho)^{L-1}}\frac{2^L}{\Omega_i{}^L(1-\rho)^{L-1}}\times\\
&\times\sum_{k_1}^{\infty}\sum_{k_2}^{\infty}\cdots\sum_{k_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_d(1-\rho)}\right)^{2\sum_{i_1=1}^{L-1}k_{i_1}}\frac{1}{\prod_{i_2=1}^{L-1}(k_{i_2}!)^2}\sum_{l_1}^{\infty}\sum_{l_2}^{\infty}\cdots\sum_{l_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_i(1-\rho)}\right)^{2\sum_{j_1=1}^{L-1}l_{j_1}}\times\\
&\times\frac{1}{\prod_{j_2=1}^{L-1}(l_{j_2}!)^2}\mu_1^{(k_1+1)\beta-1}\prod_{i_3=2}^{L-1}\mu_{i_3}^{(k_{i_3-1}+k_{i_3}+1)\beta-1}\mu_L^{(k_{L-1}+1)\beta-1}\frac{1}{2}(\Omega_i(1-\rho))^{(k_1+1)\frac{\beta}{2}+l_1+1}\times\\
&\times\frac{\beta^{p_1}}{(\sqrt{2\pi})^\beta}\sqrt{\frac{2}{\beta}}G_{\beta,2}^{2,\beta}\left[\frac{\Omega_i^\beta}{\Omega_d^2}(1-\rho)^{\beta-2}\mu_1^{2\beta}\frac{\beta^\beta}{4}\middle|\begin{matrix}\frac{1-p_1}{\beta},\frac{2-p_1}{\beta}\dots,\frac{\beta-p_1}{\beta}\\ 0,\quad 1/2\end{matrix}\right]\times\\
&\times\prod_{j_3=2}^{L-1}\left(\frac{1}{2}\left(\Omega_i\frac{(1-\rho)}{(1+\rho)}\right)^{(k_{j_3-1}+k_{j_3}+1)\frac{\beta}{2}+l_{j_3-1}+l_{j_3}+1}\frac{\beta^{p_{j_3}}}{(\sqrt{2\pi})^\beta}\sqrt{\frac{2}{\beta}}\times\right.\\
&\times G_{\beta,2}^{2,\beta}\left[\frac{\Omega_i^\beta}{\Omega_d^2}\left(\frac{(1-\rho)}{(1+\rho)}\right)^{\beta-2}\mu_2^{2\beta}\frac{\beta^\beta}{4}\middle|\begin{matrix}\frac{1-p_{j_3}}{\beta},\frac{2-p_{j_3}}{\beta},\dots,\frac{\beta-p_{j_3}}{\beta}\\ 0,\quad 1/2\end{matrix}\right]\times
\end{aligned}$$

$$\times\frac{1}{2}(\Omega_i(1-\rho))^{(k_{L-1}+1)\frac{\beta}{2}+l_{L-1}+1}\frac{\beta^{p_L}}{(\sqrt{2\pi})^{\beta}}\sqrt{\frac{2}{\beta}}\times$$
$$\times G_{\beta,2}^{2,\beta}\left[\frac{\Omega_i^{\ \beta}}{\Omega_d^{\ 2}}\cdot(1-\rho)^{\beta-2}\mu_L^{\ 2\beta}\frac{\beta^{\beta}}{4}\left|\begin{matrix}\frac{1-p_L}{\beta},\frac{2-p_L}{\beta},\ldots,\frac{\beta-p_L}{\beta}\\ 0,\quad \frac{1}{2}\end{matrix}\right.\right],L>2. \tag{6}$$

where,

$$\begin{aligned}
p_1&=(k_1+1)\frac{\beta}{2}+l_1+1,\\
p_j&=(k_{j-1}+k_j+1)\frac{\beta}{2}+l_{j-1}+i_j+1,\\
j&=2,3\ldots L-1,\\
p_L&=(k_{L-1}+1)\frac{\beta}{2}+l_{L-1}+1.
\end{aligned} \tag{7}$$

The joint cumulative distribution function of μ_1, μ_2,..., μ_L, integrals can be solved with the use of [15, eq. (26)] resulting (8).

$$F_{\mu_1\mu_2\ldots\mu_L}(\mu_1\mu_2\ldots\mu_L)=\int_0^{\mu_1}dt_1\int_0^{\mu_2}dt_2\ldots\int_0^{\mu_L}p_{\mu_1\mu_2\ldots\mu_L}(\mu_1\mu_2\ldots\mu_L)dt_L=$$
$$=\frac{\beta^L}{\Omega_d^{\ L}(1-\rho)^{L-1}}\frac{2^L}{\Omega_i^{\ L}(1-\rho)^{L-1}}\sum_{k_1}^{\infty}\sum_{k_2}^{\infty}\cdots\sum_{k_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_d(1-\rho)}\right)^{2\sum_{i_1=1}^{L-1}k_{i_1}}\times$$
$$\times\frac{1}{\prod_{i_2=1}^{L-1}(k_{i_2}!)^2}\sum_{l_1}^{\infty}\sum_{l_2}^{\infty}\cdots\sum_{l_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_i(1-\rho)}\right)^{2\sum_{j_1=1}^{L-1}l_{j_1}}\frac{1}{\prod_{j_2=1}^{L-1}(l_{j_2}!)^2}\frac{1}{2}\times$$
$$\times(\Omega_i(1-\rho))^{(k_1+1)\frac{\beta}{2}+l_1+1}\frac{\beta^{p_1}}{(\sqrt{2\pi})^{\beta}}\sqrt{\frac{2}{\beta}}\mu_1^{\beta(k_1+1)}\frac{1}{2\beta}\times$$
$$\times G_{\beta+1,3}^{2,\beta+1}\left[\frac{\Omega_i^{\ \beta}}{\Omega_d^{\ 2}}(1-\rho)^{\beta-2}\mu_1^{\ 2\beta}\frac{\beta^{\beta}}{4}\left|\begin{matrix}\frac{1-p_1}{\beta},\frac{2-p_1}{\beta},\ldots,\frac{\beta-p_1}{\beta},1-\frac{k_1+1}{2}\\ 0,\quad\frac{1}{2},\quad -\frac{k_1+1}{2}\end{matrix}\right.\right]\times$$
$$\times\prod_{j_3=2}^{L-1}\left(\frac{1}{2}\left(\Omega_i\frac{(1-\rho)}{(1+\rho)}\right)^{(k_{j_3-1}+k_{j_3}+1)\frac{\beta}{2}+l_{j_3-1}+l_{j_3}+1}\frac{\beta^{p_{j_3}}}{(\sqrt{2\pi})^{\beta}}\sqrt{\frac{2}{\beta}}\mu_{j_3}^{\ \beta(k_{j_3-1}+k_{j_3}+1)}\frac{1}{2\beta}\times\right.$$

$$\times G_{\beta,2}^{2,\beta}\left[\frac{\Omega_i^{\ \beta}}{\Omega_d^{\ 2}}\left(\frac{(1-\rho)}{(1+\rho)}\right)^{\beta-2}\mu_{j_3}^{\ 2\beta}\frac{\beta^\beta}{4}\left|\begin{matrix}\frac{1-p_{j_3}}{\beta},\frac{2-p_{j_3}}{\beta}\ldots,\frac{\beta-p_{j_3}}{\beta}\\ 0,\quad 1/2\end{matrix}\right.\right]\Bigg)\times$$

$$\times\frac{1}{2}(\Omega_i(1-\rho))^{(k_{L-1}+1)\frac{\beta}{2}+l_{L-1}+1}\frac{\beta^{p_L}}{(\sqrt{2\pi})^\beta}\sqrt{\frac{2}{\beta}}\mu_L^{\ \beta(k_{L-1}+1)}\frac{1}{2\beta}\times \tag{8}$$

$$\times G_{\beta,2}^{2,\beta}\left[\frac{\Omega_i^{\ \beta}}{\Omega_d^{\ 2}}(1-\rho)^{\beta-2}\mu_L^{\ 2\beta}\frac{\beta^\beta}{4}\left|\begin{matrix}\frac{1-p_L}{\beta},\frac{2-p_L}{\beta}\ldots,\frac{\beta-p_L}{\beta}\\ 0,\quad \frac{1}{2}\end{matrix}\right.\right],\ L>2.$$

where, p_1, p_j for j=1, 2, … L–1 and p_L are already given in (7).

3. SC RECEIVER PERFORMANCE

As known, SC diversity system selects and outputs the branch with highest SIR at each time instant.

$$\mu=\max(\mu_1\mu_2\ldots\mu_L). \tag{9}$$

CDF of SC receiver output SIR, when reception with correlated branches is performed can be determined according to [2]:

$$F(\mu)=F_{\mu_1,\mu_2,\ldots\mu_L}(\mu,\mu,\ldots\mu)=\frac{\beta^L}{\Omega_d^{\ L}(1-\rho)^{L-1}}\frac{2^L}{\Omega_i^{\ L}(1-\rho)^{L-1}}\times$$

$$\times\sum_{k_1}^{\infty}\sum_{k_2}^{\infty}\cdots\sum_{k_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_d(1-\rho)}\right)^{2\sum_{i_1=1}^{L-1}k_{i_1}}\frac{1}{\prod_{i_2=1}^{L-1}(k_{i_2}!)^2}\sum_{l_1}^{\infty}\sum_{l_2}^{\infty}\cdots\sum_{l_L}^{\infty}\left(\frac{\sqrt{\rho}}{\Omega_i(1-\rho)}\right)^{2\sum_{j_1=1}^{L-1}l_{j_1}}\times$$

$$\times\frac{1}{\prod_{j_2=1}^{L-1}(l_{j_2}!)^2}\frac{1}{2}(\Omega_i(1-\rho))^{(k_1+1)\frac{\beta}{2}+l_1+1}\frac{\beta^{p_1}}{(\sqrt{2\pi})^\beta}\sqrt{\frac{2}{\beta}}\mu^{\beta(k_1+1)}\frac{1}{2\beta}\times$$

$$\times G_{\beta+1,3}^{2,\beta+1}\left[\frac{\Omega_i^{\ \beta}}{\Omega_d^{\ 2}}(1-\rho)^{\beta-2}\mu^{2\beta}\frac{\beta^\beta}{4}\left|\begin{matrix}\frac{1-p_1}{\beta},\frac{2-p_1}{\beta}\ldots,\frac{\beta-p_1}{\beta},1-\frac{k_1+1}{2}\\ 0,\ \frac{1}{2},\quad -\frac{k_1+1}{2}\end{matrix}\right.\right]\times$$

$$\times\prod_{j_3=2}^{L-1}\left(\frac{1}{2}\left(\Omega_i\frac{(1-\rho)}{(1+\rho)}\right)^{(k_{j_3-1}+k_{j_3}+1)\frac{\beta}{2}+l_{j_3-1}+l_{j_3}+1}\frac{\beta^{p_{j_3}}}{(\sqrt{2\pi})^\beta}\sqrt{\frac{2}{\beta}}\mu^{\beta(k_{j_3-1}+k_{j_3}+1)}\frac{1}{2\beta}\times\right.$$

$$\times G_{\beta,2}^{2,\beta}\left[\frac{\Omega_i^{\ \beta}}{\Omega_d^{\ 2}}\left(\frac{(1-\rho)}{(1+\rho)}\right)^{\beta-2}\mu^{2\beta}\,\frac{\beta^{\beta}}{4}\middle|\begin{matrix}\frac{1-p_{j_3}}{\beta},\frac{2-p_{j_3}}{\beta},\ldots,\frac{\beta-p_{j_3}}{\beta}\\ 0,\quad 1/2\end{matrix}\right]\Bigg)$$

$$\times\frac{1}{2}(\Omega_i(1-\rho))^{(k_{L-1}+1)\frac{\beta}{2}+l_{L-1}+1}\,\frac{\beta^{p_L}}{(\sqrt{2\pi})^{\beta}}\sqrt{\frac{2}{\beta}}\mu^{\beta(k_{L-1}+1)}\,\frac{1}{2\beta}\times \qquad . \qquad (10)$$

$$\times G_{\beta,2}^{2,\beta}\left[\frac{\Omega_i^{\ \beta}}{\Omega_d^{\ 2}}(1-\rho)^{\beta-2}\,\mu^{2\beta}\,\frac{\beta^{\beta}}{4}\middle|\begin{matrix}\frac{1-p_L}{\beta},\frac{2-p_L}{\beta},\ldots,\frac{\beta-p_L}{\beta}\\ 0,\quad 1/2\end{matrix}\right],L>2.$$

4. NUMERICAL RESULTS

In the interference-limited environment, outage probability (OP) is defined as the probability that the output SIR of the SC falls below a given outage threshold γ_{th}, also known as a protection ratio [7].

$$P_{out}=P_R(\varsigma<\gamma_{th})=\int_0^{\gamma_{th}}p_\gamma(t)dt=F_\gamma(\gamma_{th}). \qquad (11)$$

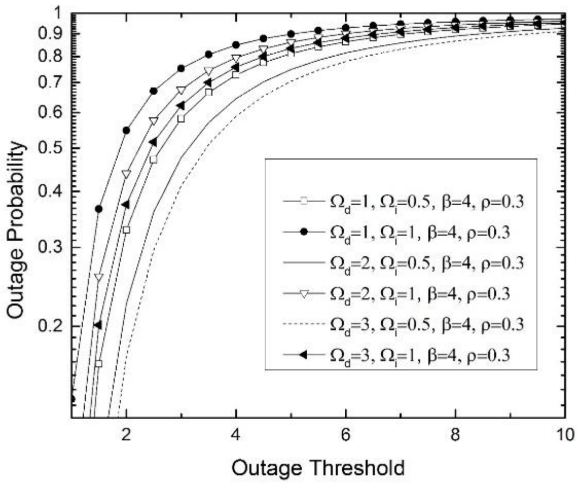

Fig. 1 Outage probability versus outage threshold

In Fig. 1, the outage probability (OP) of triple-branch SC receiver versus outage threshold for several values of average desired signal power Ω_d, average co-channel signal power Ω_i, Weibull fading severity and correlation coefficient is illustrated. As it was expected, OP increases when outage threshold increases. Furthermore, outage probability decreases when average desired signal power increases, which leads to improvement of the system performances, whereas OP increases as average co-channel interference increases. The influence of outage threshold on OP is more significant for lower values of outage threshold.

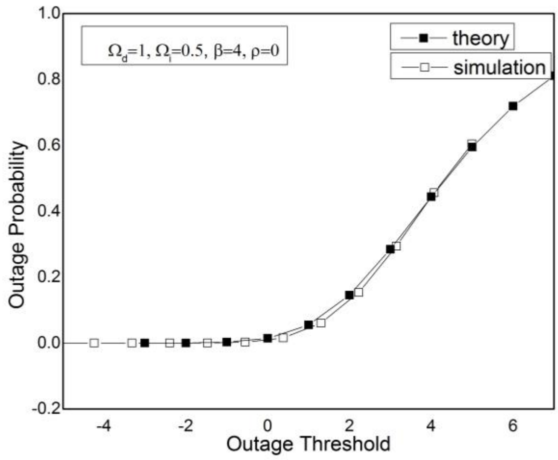

Fig. 2 Theoretical and simulation results for SC output OP

In Fig. 2, is shown the comparation of performances results (OP) obtained for observed propagation scenario by MATLAB simulation, given in terms of Meijer G function. Very close match between the curves is visible, which is the best validation of the accuracy of derived expressions, and the possibility of their application for SC receiver output SIR performance determination.

Only a few terms should be summed in Eq. (10) to achieve reasonably high accuracy. Namely accuracy at 5^{th} significant digit is obtained, for various combinations of parameters when only 10-15 terms should be summed from each infinity-sum.

6. CONCLUSION

Wireless communication system with SIR based multi-branches SC receiver operating over correlated Weibull multipath fading environment in the presence of CCI subjected to Rayleigh fading is considered and mathematically modeled. For the first time, novel, rapidly converging infinite-series expressions are derived for joint probability density function and joint cumulative distribution function for resulting signal. Capitalizing on the obtained expressions, outage probability of SC output SIR for the proposed system is efficiently evaluated. Numerical results are presented graphically and discussed in order to show the influence of transmission parameters on OP. Furthermore, we readily get OP of wireless communication system with multiple branch SC receiver operating over Rayleigh multipath fading environment in the presence of Rayleigh co-channel interference, by using general properties of Weibull distribution, and simply setting β=2 in the obtained expression for outage probability.

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