



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكروفيلم

# بسم الله الرحمن الرحيم



**HANAA ALY**



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# شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

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# **RELIABILITY ANALYSIS OF REINFORCED CONCRETE FLAT SLABS**

By

**Mohammed Ahmed Abdel-Razek Ali**

A thesis Submitted to the  
Faculty of Engineering at Cairo University  
In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science  
In  
Structural Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY  
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# Nomenclature

$\beta$	Reliability index
$\Phi$	Cumulative standard normal distribution function
$Q_x$ & $Q_y$	The internal shear force per unit length along x and y direction respectively
$M_x$ & $M_y$	The bending moment in along x and y direction respectively
$M_{xy}$ & $M_{yx}$	The twisting moment
$\omega$	Plane displacement
$\theta_x$	The rotation angles about X-axis
$\theta_y$	The rotation angles about Y-axis
$\{\varepsilon\}$	The total strain
$\{\varepsilon\}^e$	The elastic strain
$\{\varepsilon\}^p$	The plastic strain
$\sigma_{ij}$	The stress in j direction on the normal surface to i direction
E	The young's modulus
$\nu$	The passion ratio
D	The bending stiffness
$\nabla$	The Laplacian operator
$A_s$	The area of steel for unit width of the slab
$\sigma_y$	The yield stress of steel,
j d	The arm of the internal forces
$\alpha$	The yield line inclination angle with the reinforcement in X direction
$m_1$	The reinforcement in X direction
$m_2$	The reinforcement in Y direction
m	The reinforcement in X & Y direction in isotropic slab
$m_b$	The ultimate moment per unit width

$m_t$	The twisting moment per unit width
W	The external work
$E_d$	The dissipated energy
q	The lateral load on slab
$l_y$	The yield line length
$\theta$	The rotational angle of each rigid part about the yield line
Z	The safety margin
R	The resistance variable
S	The load variable
$P_f$	The probability of failure
$f_{r,s}(r,s)$	The joint probability function of both load and resistance
$F_R(r)$	The probability density function for resistance
$F_S(s)$	The probability density function for load
$f_z(z)$	The probability density of the safety margin
$\Phi$	The standard normal distribution function
$\mu_z$	The mean of the random variable Z
$\sigma_z$	The standard deviation of the random variable Z
m	The number of failure modes
c(m)	The vector of reliability indices
x(m)	Vector of normal standard correlated normal variables
R(m x m)	The correlation matrix
$\varphi(u)$	The standard density function
$\beta_i$	The reliability index of component
$\beta_j$	The reliability index of component j
z	The correlated standard normal variable.
$\rho_0$	The demarcating correlation
$\rho_{z_i,z_j}$	The mutual correlation between each two modes of safety margins $z_i, z_j$
$\sigma_{z_i}$ and $\sigma_{z_j}$	The standard deviations of safety margins $z_i, z_j$ , respectively