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This volume presents the contributions to the second France national conference “Reliability of materials and structures JN-FIAB'98”, held at University Marne-la-Valée, 23-24 November 1998. This conference was intended to survey the researches in applications of probabilistic methods to civil engineering – materials, structures’ reliability and maintainance, safety criteria and codes – and to emphasize the priority directions to follow in the future in this field. It was also intended as a “preparation” for the International conference on applications of statistics and probability, Sydney, 11-15 December 1999.

The contributions are ordered in four sections, according to the main addressed subjects. We underline that, despite the fact that the embraced domain is extremely vaste and the concrete situations considered as well as and the investigation tools (experimental observations; theoretical, mechanical, stochastic, reliability-oriented models; stochastic numerical simulations ...) are extremely various, the underlying general ideas and the general orientation of all presented contributions are the same. We mean by this the necessity to construct our conceptions of building by taking into account, at each stage of this very complex process, the influence of the uncertainty, and specific random factors.

The first section “Reliability and regulations” contains critical overviews of the current standards that govern the design of civil engineering works and indicate ways to improve them in agreement with the modern probabilistic approach to calculations of structures. The first contribution (*J. A. Calgaro*, “Reliability and civil engineering works”) discusses – on the basis of enlightening examples – the necessary improvements in the present Eurocodes through a systematic use of reliability and probabilistic methods, with the emphasis on hazard reduction, minimization of economic costs, harmonization of safety, and optimization of the inspection-maintainance-repair cycle. The same general theoretical ideas constitute the basis of the following contributions on various concrete systems: harbours and waterways (*Jean-Bernard Kovarik*, “Methods to calibrate the model factors for harbour and waterway structures”), offshore platforms (“A probabilistic approach in the requalification of the offshore platforms” by *J. Labeyrie, J. Govet, F. Schoefs*), masonry (*Alain Sellier, Ahmed Mébariki* and *Patrick Delmotte*, “Reliability of walls in masonry under wind stress”), ship design (*Pierre Marcellier, Maurice Lemaire* and *Jean Goyet*, “Calibration of partial safety factors using finite elements method”), concrete columns (*Frédéric Duprat*, “Calibration of partial safety factors: Application to concrete columns”), gravity dams (*Laurent Peyras, Stéphane Bonelli, Paul Royet*, “Formulation of a limit-state semiprobabilistic method for masonry or concrete gravity dams”).

The second chapter “Methods and actions” describes general methods to combine the stochastic mechanical models with the reliability oriented models in order to obtain reliable design recipes. Mixed theoretical and computer simulations techniques are used. Concrete examples, in an extremely wide variety of contexts (as seen below) are also discussed here in great detail. So, the first contribution by *Maurice Lemaire*, “Finite elements and reliability: A fashionable marriage” briefly presents the (stochastic) finite elements method (today the most efficient solution method of mechanical problems), and some reliability algorithms. The emphasis is on the description of their combinations (direct method, optimization method and response surface method), as well as on the abilities and disadvantages of these methods. In this spirit, the probabilistic concepts are used in modelizations of car traffic (“Probabilistic approach for the extreme values of car traffic bridge loading” by *A. J. O'Connor, B. Jacob, E. J. O'Brien* and *M. Prat*) and ship traffic (*Stéphanie Lasquellec, Jean-Michel Cornet* and *Jean-Bernard Kovarik*, “A probabilistic model for barges’ collisions against bridge piers”). Numerical simulations allow to construct a stochastic model for wood heterogeneities and their influence on the scale effects of families of planks (*D. Breysse, J. L. Clément* and *P. Renaudin*, “Modelling heterogeneities and scale effects in wooden materials”). Monte Carlo simulations are used to study the “Reliability of reinforced concrete columns subjected to fire” (*K. Sidibe, M. Pinglot, B. Bourret* and *F. Duprat*). Finally, the contribution of *Alaa Mohamed* and *Lionel Favre*, “Mechanic and reliability optimization of structures” discusses the computational costs for the structural and reliability based optimization in designing complex systems.

The third part “Works in earth and soils” presents the main ideas of reliability concepts for the interaction between the built structure and soil. A special attention is paid to the advantages of probabilistic approach as compared to the classic deterministic approach in classifying soil characteristics and in studying the soil-structure interaction. Here again, a more theoretically-oriented contribution (“Probabilistic definition of soil data” by *Daniel Boissier, Chérif Boulemia, Issa Semann and Eric Henry*) is followed by contributions that address various concrete situations (“Study of the sensitivity of the isothermal hydration of a clay barrier using probabilistic methods” by *G. Thouvenin, P. Hornet, O. Didry, A. Giraud, F. Homand and T. Lassabatère*; “Interpretation of dam monitoring results using multiple linear regression methods” by *Stéphane Bonelli, Huguette Félix and Rémi Tourment*, “Soil structures reliability. A stochastic fields approach” by *M. Gaouar, M. Fogli and C. Bacconnet*; “Estimation of the uncertainties on the results of a finite-element modelization of an embankment” by *Razik Mellah, Gabriel Auvinet and Farimah Masrouri*; “Soil-structure interaction: Towards an improved approach to soil variability” by *Denys Breysse and Michel Frappa*).

Finally, the fourth part, “Durability of the existing structures”, present new reliability tools necessary for a correct implementation of the cycle “inspection-maintenance-repair” for existing structures, and – in view of observed failures – for an improvement of structure design. Various applications to concrete ageing are presented (“Application of probabilistic methods to the analysis of ageing reinforced concrete structures: An industrial approach” by *Grégory Heinfliing, Alexis Courtois and P. Hornet*; “Modelization of concrete’s behavior: A probabilistic approach to damage” by *Alain Sellier, Bruno Capra and Ahmed Mébarki*; “Application of probabilistic methods to the analysis of the behavior of reinforced concrete structures subjected to the corrosion of rebar ” by *Ilie Petre-Lazar, Patrick Hornet, and Brune Gérard*, “Contribution of the diagnosis tools of concrete’s skin and rebar to the analysis of structure reliability” by *François Buyle-Bodin*), as well as “Calculation of reliability through a quadrature method” (*H. Baldeweck, A. Millard and P. Hornet*), a multi-scale and multi-model method for the “Prediction of the durability of building product service” (*Jérôme Lair, Jean-François Le Téo and Daniel Boissier*), “Probabilistic study of the life-time in bridge fatigue through fracture mechanics” (*Céline Andrieu and Bernard Jacob*), and an analysis of the ageing of data base “Ageing of data system. Quality of information and prediction of ageing of sewer collectors” (*Katia Laffréchine, Denys Breysse and Francis Crémoux*).

In conclusion, we strongly recommend this book as a guide to everyone interested in various aspects of modern civil engineering, as it opens new views and interesting research perspectives on subjects that were usually considered as “closed” by the classical deterministic school.

Reviewer: [Ioana Bena \(Bruxelles\)](#)

MSC:

- [74-06](#) Proceedings, conferences, collections, etc. pertaining to mechanics of deformable solids
- [74K99](#) Thin bodies, structures
- [62N05](#) Reliability and life testing
- [00B25](#) Proceedings of conferences of miscellaneous specific interest

Keywords:

[Marne-la-Vallée \(France\)](#); [Conference](#); [Proceedings](#); [JN-FIAB '98](#); [Reliability of materials](#); [Reliability of structures](#); [applied statistics](#); [stochastic finite elements method](#); [direct method](#); [probabilistic methods](#); [civil engineering](#); [reliability-oriented models](#); [stochastic numerical simulations](#); [Eurocodes](#); [hazard reduction](#); [inspection-maintenance-repair cycle](#); [harbours](#); [waterways](#); [offshore platforms](#); [masonry](#); [finite elements method](#); [concrete columns](#); [gravity dams](#); [optimization method](#); [response surface method](#); [car traffic](#); [ship traffic](#); [scale effects in wooden materials](#); [soil-structure interaction](#); [concrete ageing](#); [reinforced concrete structures](#); [corrosion of rebar](#); [fracture mechanics](#)