

## Publications by Iason Papaioannou

January 2025

### HIGHLIGHTS

76 refereed journal papers; 2 book chapters; 64 refereed conference papers  
> 4000 citations; h-index 30; i10-index 60 ([Google scholar profile](#))

### REFEREED JOURNAL PUBLICATIONS

**[J76]** Cheng K., **Papaioannou I.**, Straub D. Enhanced sequential directional importance sampling for structural reliability analysis. *Structural Safety*, in print.

**[J75]** Ellingwood B., Maes M., Beck A. T., Caprani C., Der Kiureghian A., Duenas-Osorio L., Galvao N., Gilbert R. B., Li J., Matos J., Mori Y., **Papaioannou I.**, Parades R., Straub D., Sudret B. (2025). Development of methods of structural reliability. *Structural Safety*, 113: 102474.

**[J74]** Chan J., Paredes R., **Papaioannou I.**, Duenas-Osorio L., Straub D. (2025). Adaptive Monte Carlo methods for estimating rare events in power grids. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, 11(1): 04024082.

**[J73]** Graham-Brady L., Hogarth J., **Papaioannou I.** (2024). Data-driven prediction of extreme value distributions of finite-length random processes with application to fiber strength statistics. *Computer Methods in Applied Mechanics and Engineering*, 432: 117431.

**[J72]** Schneider F., **Papaioannou I.**, Sudret B., Müller G. (2024). Maximum a posteriori estimation for linear structural dynamics models using Bayesian optimization with rational polynomial chaos expansions. *Computer Methods in Applied Mechanics and Engineering*, 432: 117418.

**[J71]** Chan J., **Papaioannou I.**, Straub D. (2024). Bayesian improved cross entropy method with categorical mixture models for network reliability assessment. *Reliability Engineering & System Safety*, 252: 110432.

**[J70]** Carrera B., **Papaioannou I.** (2024). Covariance-based MCMC for high-dimensional Bayesian updating with sequential Monte Carlo. *Probabilistic Engineering Mechanics*, 77: 103667.

**[J69]** Hoppe K.-A., Ramírez Hönack P.F., Schmid S., Kollofrath J., Chocholaty B., **Papaioannou I.**, Marburg S. (2024). Predicting the elastic properties of Norway spruce by its morphology. *International Journal of Mechanical Sciences*, 282: 109570.

**[J68]** Li L.Y., **Papaioannou I.**, Straub D. (2024). Efficient global sensitivity analysis method for dynamic models in high dimensions. *International Journal for Numerical Methods in Engineering*, 125(15): e7494.

- [J67] Althaus K., **Papaioannou I.**, Ullmann E. (2024). Consensus-based rare event estimation. *SIAM Journal on Scientific Computing*, 46(3): A1487-A1513.
- [J66] Zwirgmaier K., Chan J., **Papaioannou I.**, Song J., Straub D. (2024). Hybrid Bayesian networks for reliability assessment of infrastructure systems. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, 10(2): 04024019.
- [J65] Ehre M., **Papaioannou I.**, Straub D. (2024). Variance-based reliability sensitivity under dependent inputs using failure samples. *Structural Safety*, 106: 102396.
- [J64] Kamariotis A., Sardi L., **Papaioannou I.**, Chatzi E., Straub D. (2023). On off-line and on-line Bayesian filtering for uncertainty quantification of structural deterioration. *Data-Centric Engineering*, 4: e17.
- [J63] Geyer S., **Papaioannou I.**, Straub D. (2023). Spatial modeling of concrete strength based on data. *Structural Safety*, 103: 102345.
- [J62] Chan J., **Papaioannou I.**, Straub D. (2023). Bayesian improved cross entropy method for network reliability assessment. *Structural Safety*, 103: 102344.
- [J61] Kanjilal O., **Papaioannou I.**, Straub D. (2023). Bayesian updating of reliability by cross entropy-based importance sampling. *Structural Safety*, 102: 102325.
- [J60] Schneider F., **Papaioannou I.**, Müller G. (2023). Sparse Bayesian learning for complex-valued rational approximations. *International Journal for Numerical Methods in Engineering*, 124: 1721-1747.
- [J59] Ehre M., Flock R., Fußender M., **Papaioannou I.**, Straub D. (2023). Certified dimension reduction for Bayesian updating with the cross-entropy method. *SIAM/ASA Journal on Uncertainty Quantification*, 11(1): 358-388.
- [J58] Engel M., Kanjilal O., **Papaioannou I.**, Straub D. (2023). Bayesian updating and marginal likelihood estimation by cross entropy-based importance sampling. *Journal of Computational Physics*, 473: 111746.
- [J57] Cheng K., **Papaioannou I.**, Lu Z., Zhang X., Wang Y. (2023). Rare event estimation with sequential directional importance sampling. *Structural Safety*, 100: 102291.
- [J56] Stefanou G., Savvas D., Gavallas P., **Papaioannou I.** (2022). The effect of random field parameter uncertainty on the response variability of composite structures. *Composites Part C: Open Access*, 9: 100324.
- [J55] Betz W., **Papaioannou I.**, Straub D. (2022). Bayesian post-processing of Monte Carlo simulation in reliability analysis. *Reliability Engineering & System Safety*, 227: 108731.
- [J54] Chan J., **Papaioannou I.**, Straub D. (2022). An adaptive subset simulation algorithm for system reliability analysis with discontinuous limit states. *Reliability Engineering & System Safety*, 225: 108607.

- [J53] Betz W., **Papaioannou I.**, Zeh T., Hespings D., Krauss T., Straub D. (2022). Data-driven predictive maintenance for gas distribution networks. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, 8(2): 04022016.
- [J52] Ehre M., **Papaioannou I.**, Sudret, B., Straub D. (2022). Sequential active learning of low-dimensional model representations for reliability analysis. *SIAM Journal on Scientific Computing*, 44(3): B558-B584.
- [J51] Deng Q.-X., He J., Cao Z.-J., **Papaioannou I.**, Li D.-Q., Phoon, K.-K. (2022). Bayesian learning of Gaussian mixture model for calculating debris flow exceedance probability. *Georisk*, 16(1): 154-177.
- [J50] Wagner P.-R., Marelli S., **Papaioannou I.**, Straub D., Sudret B. (2022). Rare event estimation using stochastic spectral embedding. *Structural Safety*, 96: 102179.
- [J49] Geyer S., **Papaioannou I.**, Graham-Brady L., Straub D. (2022). The spatial averaging method for non-homogeneous random fields with application to reliability analysis. *Engineering Structures*, 253: 113761.
- [J48] Straub D., Ehre M., **Papaioannou I.** (2022). Decision-theoretic reliability sensitivity. *Reliability Engineering & System Safety*, 221: 108215.
- [J47] Wagner F., **Papaioannou I.**, Ullmann E. (2022). The ensemble Kalman filter for rare event estimation. *SIAM/ASA Journal on Uncertainty Quantification*, 10(1): 317-349.
- [J46] Schneider F., **Papaioannou I.**, Straub D., Winter C., Müller G. (2022). Bayesian parameter updating in linear structural dynamics with frequency transformed data using rational surrogate models. *Mechanical Systems and Signal Processing*, 166: 108407.
- [J45] Kanjilal O., **Papaioannou I.**, Straub D. (2022). Series system reliability of uncertain linear structures under Gaussian excitation by cross entropy-based importance sampling. *ASCE Journal of Engineering Mechanics*, 148(1): 04021136.
- [J44] Geyer S., **Papaioannou I.**, Straub D. (2021). Bayesian analysis of hierarchical random fields for material modeling. *Probabilistic Engineering Mechanics*, 66: 103167.
- [J43] Korshunova N., **Papaioannou I.**, Kollmannsberger S., Straub D., Rank E. (2021). Uncertainty quantification of microstructure variability and mechanical behavior of additively manufactured lattice structures. *Computer Methods in Applied Mechanics and Engineering*, 385: 114049.
- [J42] Uribe F., **Papaioannou I.**, Latz J., Betz W., Ullmann E., Straub D. (2021). Bayesian inference with subset simulation in varying dimensions applied to the Karhunen-Loève expansion. *International Journal for Numerical Methods in Engineering*, 122: 5100-5127.
- [J41] Wagner F., Latz J., **Papaioannou I.**, Ullmann E. (2021). Error analysis for probabilities of rare events with approximate models. *SIAM Journal on Numerical Analysis*, 59(4): 1948-1975.
- [J40] Ehre M., **Papaioannou I.**, Willcox, K. E., Straub D. (2021). Conditional reliability analysis in high dimensions based on controlled mixture importance sampling and

information reuse. *Computer Methods in Applied Mechanics and Engineering*, 381: 113826.

[J39] Kanjilal O., **Papaioannou I.**, Straub D. (2021). Cross entropy-based importance sampling for first-passage probability estimation of linear structures with parameter uncertainties. *Structural Safety*, 91: 102090.

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[J36] **Papaioannou I.**, Straub D. (2021). Combination line sampling for structural reliability analysis. *Structural Safety*, 88: 102025.

[J35] Carrera B., Mok C. M., **Papaioannou I.** (2020). Efficient estimation of hydraulic conductivity heterogeneity with non-redundant measurement information. *International Journal on Geomathematics*, 11: 15.

[J34] Tsilifis P., **Papaioannou I.**, Straub D., Nobile F. (2020). Sparse polynomial chaos expansions using variational relevance vector machines. *Journal of Computational Physics*, 416: 109498.

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- [J26] Jiang S.H., **Papaioannou I.**, Straub D. (2020). Optimization of site exploration program for slope reliability assessment. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, 6(1): 04020004.
- [J25] **Papaioannou I.**, Geyer S., Straub D. (2019). Improved cross entropy-based importance sampling with a flexible mixture model. *Reliability Engineering & System Safety*, 191: 106564.
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- [J23] **Papaioannou I.**, Ehre M., Straub D. (2019). PLS-based adaptation for efficient PCE representation in high dimensions. *Journal of Computational Physics*, 387: 186-204.
- [J22] Pivovarov D., Willner K., Steinmann P., Brumme S., Müller M., Srisupattarawanit T., Ostermeyer G.-P., Henning C., Ricken T., Kastian S., Reese S., Moser D., Grasedyck L., Biehler J., Pfaller M., Wall W., Kolsche T., v. Estorff O., Gruhlke R., Eigel M., Ehre M., **Papaioannou I.**, Straub D., Leyendecker S. (2019). Challenges of order reduction techniques for problems involving polymorphic uncertainty. *GAMM-Mitteilungen*, 42(2): e201900011.
- [J21] **Papaioannou I.**, Daub M., Drieschner M., Duddeck F., Ehre M., Eichner L., Eigel M., Götz M., Graf W., Grasedyck L., Gruhlke R., Hömberg D., Kaliske M., Moser D., Petryna Y., Straub D. (2019). Assessment and design of an engineering structure with polymorphic uncertainty quantification. *GAMM-Mitteilungen*, 42(2): e201900009.
- [J20] Geyer S., **Papaioannou I.**, Straub D. (2019). Cross entropy-based importance sampling using Gaussian densities revisited. *Structural Safety*, 76: 15-27.
- [J19] Yuan J., **Papaioannou I.**, Straub D. (2019). Probabilistic failure analysis of infinite slopes under random rainfall processes and spatially random soil. *Georisk*, 13(1): 20-33.
- [J18] **Papaioannou I.**, Breitung K., Straub D. (2018). Reliability sensitivity estimation with sequential importance sampling. *Structural Safety*, 75: 24-34.
- [J17] Latz J., **Papaioannou I.**, Ullmann E. (2018). Multilevel Sequential<sup>2</sup> Monte Carlo for Bayesian inverse problems. *Journal of Computational Physics*, 368: 154-178.
- [J16] Jiang S.H., **Papaioannou I.**, Straub D. (2018). Bayesian updating of slope reliability in spatially variable soils with in-situ measurements. *Engineering Geology*, 239: 310-320.
- [J15] Betz W., Beck J. L., **Papaioannou I.**, Straub D. (2018). Bayesian inference with reliability methods without knowing the maximum of the likelihood function. *Probabilistic Engineering Mechanics*, 53: 14-22.
- [J14] Betz W., **Papaioannou I.**, Beck J. L., Straub D. (2018). Bayesian inference with subset simulation: Strategies and improvements. *Computer Methods in Applied Mechanics and Engineering*, 331: 72-93.
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- [J11] **Papaioannou I.**, Straub D. (2017). Learning soil parameters and updating geotechnical reliability estimates under spatial variability – theory and application to shallow foundations. *Georisk*, 11(1): 116-128.
- [J10] Depina I., **Papaioannou I.**, Straub D., Eiksund, G. (2017). Coupling the cross-entropy with the line sampling method for risk-based design optimization. *Structural and Multidisciplinary Optimization*, 55(5): 1589-1612.
- [J9] **Papaioannou I.**, Papadimitriou C., Straub D. (2016). Sequential importance sampling for structural reliability analysis. *Structural Safety*, 62: 66-75.
- [J8] Straub D., **Papaioannou I.**, Betz W. (2016). Bayesian analysis of rare events. *Journal of Computational Physics*, 314: 538-556.
- [J7] Betz W., **Papaioannou I.**, Straub D. (2016). Transitional Markov chain Monte Carlo: Observations and improvements. *ASCE Journal of Engineering Mechanics*, 142(5): 04016016.
- [J6] Ullmann E., **Papaioannou I.** (2015). Multilevel estimation of rare events. *SIAM/ASA Journal on Uncertainty Quantification*, 3(1): 922-953.
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- [J4] Straub D., **Papaioannou I.** (2015). Bayesian updating with structural reliability methods. *ASCE Journal of Engineering Mechanics*, 141(3): 04014134.
- [J3] Betz W., **Papaioannou I.**, Straub D. (2014). Numerical methods for the discretization of random fields by means of the Karhunen-Loève expansion. *Computer Methods in Applied Mechanics and Engineering*, 271: 109-129.
- [J2] **Papaioannou I.**, Gao R., Rank E., Wang C. M. (2013). Stochastic hydroelastic analysis of pontoon-type very large floating structures considering directional wave spectrum. *Probabilistic Engineering Mechanics*, 33: 26-37.
- [J1] **Papaioannou I.**, Straub D. (2012). Reliability updating in geotechnical engineering including spatial variability of soil. *Computers and Geotechnics*, 42: 44-51.

#### DISSERTATION

- [D1] **Papaioannou I.** (2013). *Non-intrusive finite element reliability analysis – Structural reliability analysis with “black box” finite element programs*. SVH-Verlag, Saarbrücken.

#### BOOK CHAPTERS

- [B2] Straub D., **Papaioannou I.**, Betz W. (2017). Reliability updating in the presence of spatial variability. In *Risk and Reliability Analysis: Theory and Applications* (ed. P. Gardoni), Springer.

[B1] Straub D., **Papaioannou I.** (2015). Bayesian analysis for learning and updating geotechnical parameters and models with measurements. In *Risk and Reliability in Geotechnical Engineering* (eds. K.K. Phoon and J. Y. Ching), CRC Press, Boca Raton, FL.

## REPORTS

[R1] Zhang J., Boothroyd P., Calvello M., Eddleston M., Cañavate-Grimal A., **Papaioannou I.**, Luo Z., Najjar S., Rodriguez-Marek A., Straub D., Uzielli M., Wang Y., Walter, H. (2017). Bayesian Method: A Natural Tool for Processing Geotechnical Information. TC205/TC304 Discussion Groups, ISSMGE.

## REFEREED CONFERENCE PAPERS

[C64] Zinas O., **Papaioannou I.**, Schneider R., Cuéllar P. (2024). Multivariate Gaussian process for 3D subsurface stratigraphy prediction from CPT and labelled borehole data. *Proc. 7th International Conference on Geotechnical and Geophysical Site Characterization*, Barcelona, Spain.

[C63] Spross J., Grasmick J., **Papaioannou I.** (2024). Toward probabilistic ground models for time and cost estimation of tunnel projects. *Proc. 7th International Conference on Geotechnical and Geophysical Site Characterization*, Barcelona, Spain.

[C62] Le T.M.H., Tavakoli S., L'Heureux J.-S., **Papaioannou I.** (2023). Use of Electrical Resistivity Tomography for detecting quick clay in Norway. *Proc. 5th International Conference on Geotechnics for Sustainable Infrastructure Development - GEOTEC HANOI 2023*, Hanoi, Vietnam.

[C61] Schatz B., Peña-Olarte A.A., Ribera A., Schorr J., **Papaioannou I.**, Cudmani R. (2023). Reliability-based analysis of tailings storage facilities. A case study: Cadia NTSF embankment failure. *Proc. 1st International Conference on Geotechnics of Tailings and Mine Waste*, Ouro Preto, Minas Gerais, Brazil.

[C60] **Papaioannou I.**, Kanjilal O., Le T.M.H., Tsegaye A.B., L'Heureux J.-S. (2023). Dealing with uncertainties in detecting and characterizing quick clay in Norway. *Proc. Geo-Risk 2023*, Arlington, Virginia.

[C59] Kanjilal O., **Papaioannou I.**, Straub D. (2023). An efficient strategy for reliability-based design optimization of linear structural dynamic systems by the cross-entropy method. *Proc. 14th International Conference on Applications of Statistics and Probability in Civil Engineering*, Dublin, Ireland.

[C58] Jiang S.-H., Ouyang S., **Papaioannou I.** (2023). A hybrid approach for deriving probability distributions of rock mass discontinuity parameters for slope reliability analysis. *Proc. 14th International Conference on Applications of Statistics and Probability in Civil Engineering*, Dublin, Ireland.

[C57] Chan J.P., Paredes R., **Papaioannou I.**, Duenas-Osorio L., Straub D. (2023). A comparative study on adaptive Monte Carlo methods for network reliability assessment. *Proc. 14th International Conference on Applications of Statistics and Probability in Civil Engineering*, Dublin, Ireland.

[C56] Jiang S.-H., Liu X., **Papaioannou I.** (2022). Bayesian updating of slope reliability under rainfall infiltration with field observations. *Proc. 8th International Symposium on Geotechnical Safety and Risk*, Newcastle, Australia.

[C55] Zeng G., **Papaioannou I.**, Cao Z.-J. (2022). Bayesian Gaussian mixture model learning with subset simulation. *Proc. 8th International Symposium on Geotechnical Safety and Risk*, Newcastle, Australia.

[C54] **Papaioannou I.**, Geyer S., Straub D. (2022). Bayesian hierarchical spatial modeling of soil properties. *Proc. 8th International Symposium on Geotechnical Safety and Risk*, Newcastle, Australia.

[C53] Wagner P.-R., **Papaioannou I.**, Marelli S., Straub D., Sudret B. (2022). Estimating failure probabilities using an adaptive variant of stochastic spectral embedding. *Proc. 13th International Conference on Structural Safety and Reliability*, Shanghai, China.

[C52] Jiang S.-H., **Papaioannou I.**, Liu X., Huang J. (2022). Bayesian analysis of slope parameters involving multiple observations using an improved BUS approach. *Proc. 13th International Conference on Structural Safety and Reliability*, Shanghai, China.

[C51] Kanjilal O., **Papaioannou I.**, Straub D. (2022). Structural reliability updating by cross entropy-based importance sampling. *Proc. 13th International Conference on Structural Safety and Reliability*, Shanghai, China.

[C50] Chan J.P., **Papaioannou I.**, Straub D. (2022). Improved cross entropy-based importance sampling for network reliability assessment. *Proc. 13th International Conference on Structural Safety and Reliability*, Shanghai, China.

[C49] **Papaioannou I.**, Straub D. (2022). Reliability sensitivity analysis with FORM. *Proc. 13th International Conference on Structural Safety and Reliability*, Shanghai, China.

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[C45] Kanjilal O., **Papaioannou I.**, Straub D. (2020). Series system reliability estimation of randomly excited uncertain linear structures by cross entropy-based importance sampling. *Proc. 7th Asian-Pacific Symposium on Structural Reliability and its Applications*, Tokyo, Japan.

[C44] Geyer S., **Papaioannou I.**, Straub D. (2020). Characteristic values of spatially varying material properties in existing structures. *Proc. 7th International Symposium on Life-Cycle Civil Engineering*, Shanghai, China.

[C43] Papaioannou I., Geyer S., Straub D. (2019). Bayesian updating of foundation reliability with spatially variable measurements: A spatial averaging approach. *Proc. 7th International Symposium on Geotechnical Safety and Risk*, Taipei, Taiwan.

[C42] Kamariotis A., Antinori G., Papaioannou I., Duddeck F. (2019). Mixed aleatory-epistemic uncertainty quantification and sensitivity analysis. *Proc. 17th International Probabilistic Workshop*, Edinburgh, UK.

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[C38] Geyer S., Papaioannou I., Kunz C., Straub D. (2018). Reliability assessment of large hydraulic structures with spatially distributed measurements. *Proc. 6th International Symposium on Life-Cycle Civil Engineering*, Ghent, Belgium.

[C37] Papaioannou I., Ehre M., Straub D. (2018). Efficient PCE representation for reliability analysis in high dimensions. *IFIP WG7.5 Working Conference on Reliability and Optimization of Structural Systems*, Zurich, Switzerland.

[C36] Ehre M., Papaioannou I., Straub D. (2018). Efficient estimation of variance-based reliability sensitivities in the presence of multi-uncertainty. *IFIP WG7.5 Working Conference on Reliability and Optimization of Structural Systems*, Zurich, Switzerland.

[C35] Jiang S.H., Papaioannou I., Li C.-G., Straub D. (2017). Integrating LEM with FEM through model correction factor method in reliability analysis of spatially variable slopes. *Proc. 15th International Conference of the International Association for Computer Methods and Advances in Geomechanics*, Wuhan, China.

[C34] Geyer S., Papaioannou I., Straub D. (2017). On the efficiency of cross entropy-based importance sampling with Gaussian densities. *Proc. 15th International Probabilistic Workshop*, Dresden, Germany.

[C33] Zwirgmaier K., Papaioannou I., Straub D. (2017). Enhancing sampling based inference in hybrid BNs for reliability assessment. *Proc. 12th International Conference on Structural Safety and Reliability* (eds. C. Bucher, B.R. Ellingwood and D.M. Frangopol), Vienna, Austria.

[C32] Papaioannou I., Straub D. (2017). Efficient sampling of non-Gaussian priors in high dimensions. *Proc. 12th International Conference on Structural Safety and Reliability* (eds. C. Bucher, B.R. Ellingwood and D.M. Frangopol), Vienna, Austria.

[C31] Uribe F., **Papaioannou I.**, Betz W., Ullmann E., Straub D. (2017). Random fields in Bayesian inference: Effects of random field discretization. *Proc. 12th International Conference on Structural Safety and Reliability* (eds. C. Bucher, B.R. Ellingwood and D.M. Frangopol), Vienna, Austria.

[C30] Uribe F., **Papaioannou I.**, Betz W., Latz J., Straub D. (2017). Bayesian model inference of random fields represented with the Karhunen-Loève expansion. *Proc. 2nd ECCOMAS Thematic Conference on Uncertainty Quantification in Computational Sciences and Engineering* (eds. M. Papadrakakis, V. Papadopoulos and G. Stefanou), Rhodes Island, Greece.

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[C28] Jiang S.H., **Papaioannou I.**, Straub D. (2017). Optimizing borehole locations for slope reliability assessment. *Proc. 6th International Symposium on Geotechnical Safety and Risk/Geo-Risk 2017*, Denver, Colorado.

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[C22] **Papaioannou I.**, Der Kiureghian A. (2014). EOLE for discretization of multivariate random fields. *Computational Stochastic Mechanics, CSM-7* (eds. G. Deodatis and P.D. Spanos), Santorini, Greece.

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