

Reflectivity Calculations, Modelling and Software - a Bibliography

Adrian R. Rennie

This list of publications provides references for calculation methods used to model X-ray and neutron reflection data. Papers that describe particular computer programs or software are specifically included. The document starts with a short narrative account that may guide readers to particular topics and a chronological list of references. Other documents provide guides to literature with lists of general introductions to the subject and review articles, and to papers with specific details of neutron reflectometers.

Phenomenology of X-ray reflection

Interference patterns in specular reflection of X-rays from thin films were described by [Kiessig](#). The enhanced scattering that arises from roughness away from the specular angle was described by [Yoneda](#).

Theoretical Concepts and Mathematics of Reflectivity Calculations

The mathematics used to calculate reflectivity from multilayers using optical methods is described by [Abelès](#) and by [Parratt](#). A simple procedure to include a small interfacial roughness was introduced by [Nénot and Croce](#), and by [Cowley and Ryan](#). The scattering theory of reflectivity is described by [Crowley](#). The derivation of the expression for reflectivity based on the kinematic scattering approximation is carefully explained in an article by [Sivia](#). The off-specular scattering from rough interfaces is described by [Sinha et al.](#) and by [Garoff et al.](#) [Reiss and Lipperheide](#) emphasise the importance of allowing for reflection from the back surface of substrates when they are significantly transparent. Particular extensions to theory for calculations for magnetic structures studied with neutrons are given by [Blundell and Bland](#), [Fermon](#) and by [Radu and Ignatovich](#) who provide a general matrix method that can account for arbitrary directions of magnetisation. The effects of the wave coherence of neutron beams are discussed in papers by [Majkrzak et al.](#) and by [Berk](#).

Resolution of Neutron Reflectometers

The smearing of reflectivity that arises from instrument effects is particularly important in neutron reflection measurements. The width of the resolution function for time-of-flight reflectometers is described by [van Well and Fredrikze](#). The non-Gaussian shape of the resolution function is calculated by [Nelson and Dewhurst](#). [Wildes](#) discusses inelastic scattering and the energy resolution of a reflectometer.

Fitting Algorithms, Regularisation and Uniqueness

Methods to resolve the uncertainty (lack of uniqueness) that arises from loss of phase information are described by [Leeb et al.](#) ([2000a](#), [2000b](#)). [Björck](#) compares fitting algorithms in the context of reflectivity experiments. [Sivia and Webster](#) discuss Bayesian methods for fitting. Genetic algorithms are described by [de Haan and Drijkoningen](#), and by [Björck and Andersson](#). [Lu and Thomas](#) relate uncertainty to experimental factors in the light of scattering theory.

Software Packages

A number of papers describe particular computer programs that are used for analysis of reflectivity data or modelling. These include IMD by [Windt](#), GenX by [Björck and Andersson](#) and Motofit by [Nelson](#). [Ulyanekov](#) provides an account of the Leptos package. A round-robin comparison of X-ray reflection measurements and data analysis, particularly using IMD, was described by [Colombi et al.](#) [Barlow et al.](#) and [Muslim et al.](#) describe molecular modelling that is constrained by neutron reflection data. The KsRefl and REFLPAK software for neutron reflectivity applied to magnetic structures is described by [Mont et al.](#) [Danauskas et al.](#) give an account of the Stochfit program. Although primarily intended for analysis of small-angle scattering data, the IRENA program described by [Ilavsky and Jemian](#) also includes simple calculations for reflectivity. [Crabb et al.](#) describe the REX program that includes energy dependent effects for X-rays and modelling with multiple wavelengths.

Some recent developments have included explicit evaluation of the effects of coherence by [Berk](#) together with experimental tests by [Majkrzak et al.](#) Methods to resolve the ambiguity of phase have been presented by [Babanov et al.](#)

Many programs are available but are not the subject of particular publications in journals although they are documented elsewhere. A web catalogue is provided by Rennie: <http://www.reflectometry.net/reflect.htm>.

I would be pleased to receive corrections to any mistakes in this bibliography and to have information about new relevant papers.

© Copyright Adrian R. Rennie,
2013, 2014, 2015, 2016, 2017.

Seq. No.	Reference	Digital Source	Year
1	H. Kiessig, 'Interference of X-rays in thick layers' <i>Annalen der Physik</i> 10 , (1931), 769-788.	http://dx.doi.org/10.1002/andp.19314020702	1931
2	F. Abelès, 'Investigations on the propagation of sinusoidal electromagnetic waves in stratified media. Application to thin films' <i>Annales de Physique</i> , 5 , (1950), 596-640.		1950
3	F. Abelès, 'Investigations on the propagation of sinusoidal electromagnetic waves in stratified media. Application to thin films. II. Thin films' <i>Annales de Physique</i> , 5 , (1950), 706-784.		1950
4	F. Abelès 'La théorie générale des couches minces' <i>J. Phys. Radium</i> 11 , (1950), 307-309.	http://dx.doi.org/10.1051/jphysrad:01950001107030700	1950
5	F. Abelès 'La détermination de l'indice et de l'épaisseur des couches minces transparentes' <i>J. Phys. Radium</i> 11 , (1950), 310-314.	http://dx.doi.org/10.1051/jphysrad:01950001107031000	1950
6	L. G. Parratt 'Surface Studies of Solids by Total Reflection of X-Rays' <i>Physical Review</i> , 95 , (1954), 359-369.	http://dx.doi.org/10.1103/PhysRev.95.359	1954
7	O. S. Heavens 'Optical properties of thin films' <i>Rep. Prog. Phys.</i> 23 , (1960), 1-65.	http://dx.doi.org/10.1088/0034-4885/23/1/301	1960
8	Y. Yoneda 'Anomalous Surface Reflection of X Rays' <i>Physical Review</i> 131 , (1963), 2010-2013.	http://dx.doi.org/10.1103/PhysRev.131.2010	1963
9	P. Croce, L. Névoit 'Influence des interfaces rugueux sur la réflexion spéculaire des rayons X' <i>J. Appl. Cryst.</i> 7 , (1974), 125-130.	http://dx.doi.org/10.1107/S0021889874008946	1974
10	A. A. Maradudin, D. L. Mills. 'Scattering and absorption of electromagnetic radiation by a semi-infinite medium in the presence of surface roughness' <i>Phys. Rev. B</i> , 11 , (1975), 1392-1415.	http://dx.doi.org/10.1103/PhysRevB.11.1392	1975

Seq. No.	Reference	Digital Source	Year
11	L. Névoit, P. Croce 'Characterization of Surfaces by Grazing X-Ray Reflection - Application to Study of Polishing of Some Silicate-Glasses' 'Caractérisation des surfaces par réflexion rasante de rayons X. Application à l'étude du polissage de quelques verres silicates' <i>Revue de Physique Appliquée</i> 15 , (1980,) 761-779.	http://dx.doi.org/10.1051/rphysap:01980001503076100	1980
12	R. A. Cowley, T. W. Ryan 'X-ray scattering studies of thin films and surfaces: thermal oxides on silicon' <i>J. Phys. D: Appl. Phys.</i> 20 , (1987), 61-68.	http://dx.doi.org/10.1088/0022-3727/20/1/010	1987
13	J. Lekner, <i>Theory of Reflection of Electromagnetic and Particle Waves</i> , Martinus Nijhoff, Dordrecht, (1987).		1987
14	S. K. Sinha, E. B. Sirota, S. Garoff, H. B. Stanley 'X-ray and neutron scattering from rough surfaces' <i>Physical Review B</i> , 38 , (1988), 2297-2311.	http://dx.doi.org/10.1103/PhysRevB.38.2297	1988
15	S. Garoff, E. B. Sirota, S. K. Sinha, H. B. Stanley 'The effects of substrate roughness on ultrathin water films' <i>Journal of Chemical Physics</i> , 90 , (1989), 7505-7514.	http://dx.doi.org/10.1063/1.456184	1989
16	John Lekner 'Reflection theory and the analysis of neutron reflection data' <i>Physica B</i> , 173 , (1991), 99-111.	http://dx.doi.org/10.1016/0921-4526(91)90040-L	1991
17	S. K. Sinha, 'Reflectivity using neutrons or X-rays? A critical comparison', <i>Physica B: Condensed Matter</i> , 173 , (1991), 25-34.	http://dx.doi.org/10.1016/0921-4526(91)90031-9	1991
18	S. J. Blundell, J. A. C. Bland 'Polarized neutron reflection as a probe of magnetic films and multilayers' <i>Physical Review B</i> , 46 , (1992), 3391-3400.	http://dx.doi.org/10.1103/PhysRevB.46.3391	1992
19	Roger Pynn 'Neutron scattering by rough surfaces at grazing incidence' <i>Phys. Rev. B</i> 45 , (1992), 602-612.	http://dx.doi.org/10.1103/PhysRevB.45.602	1992

Seq. No.	Reference	Digital Source	Year
20	W. Weber, B. Lengeler. 'Diffuse scattering of hard x-rays from rough surfaces' <i>Phys. Rev. B</i> , 46 , (1992), 7953–7956.	http://dx.doi.org/10.1103/PhysRevB.46.7953	1992
21	William L. Clinton 'Phase determination in x-ray and neutron reflectivity using logarithmic dispersion relations' <i>Phys. Rev. B</i> , 48 , (1993), 1-5.	http://dx.doi.org/10.1103/PhysRevB.48.1	1993
22	T. A. Crabb, P. N. Gibson, K. J. Roberts 'REX - a least-squares fitting program for the simulation and analysis of X-ray reflectivity data' <i>Computer Physics Communications</i> 77 , (1993), 441-449.	http://dx.doi.org/10.1016/0010-4655(93)90188-l	1993
23	T. L. Crowley 'A uniform kinematic approximation for specular reflectivity' <i>Physica A</i> , 195 , (1993), 354-374.	http://dx.doi.org/10.1016/0378-4371(93)90163-X	1993
24	Huai Zhang, J. W. Lynn 'New exact solution of the one-dimensional Schrödinger equation and its application to polarized neutron reflectometry' <i>Phys. Rev. Lett.</i> 70 , (1993), 77-80.	http://dx.doi.org/10.1103/PhysRevLett.70.77	1993
25	D. K. G. de Boer. 'Influence of the roughness profile on the specular reflectivity of x-rays and neutrons' <i>Phys. Rev. B</i> , 49 , (1994), 5817–5820.	http://dx.doi.org/10.1103/PhysRevB.49.5817	1994
26	V.-O. de Haan, G.G. Drijkoningen 'Genetic algorithms used in model finding and fitting for neutron reflection experiments' <i>Physica B: Condensed Matter</i> , 198 , (1994), 24-26.	http://dx.doi.org/10.1016/0921-4526(94)90118-X	1994
27	I. W. Hamley, J. S. Pedersen 'Analysis of neutron and X-ray reflectivity data. I. Theory' <i>J. Appl. Cryst.</i> 27 , (1994), 29-35.	http://dx.doi.org/10.1107/S0021889893006260	1994
28	J. S. Pedersen, I. W. Hamley 'Analysis of neutron and X-ray reflectivity data. II. Constrained least-squares methods' <i>J. Appl. Cryst.</i> 27 , (1994), 36-49.	http://dx.doi.org/10.1107/S0021889893006272	1994

Seq. No.	Reference	Digital Source	Year
29	N. K. Pleshanov 'Neutrons at the boundary of magnetic media' <i>Z. Phys. B</i> 94 , (1994), 233-243.	http://dx.doi.org/10.1007/BF01320674	1994
30	G. Reiss, R. Lipperheide, 'Thick samples in neutron specular reflection', <i>Physics Letters A</i> , 196 , (1994), 133-138.	http://dx.doi.org/10.1016/0375-9601(94)91058-8	1994
31	V.-O. de Haan, A. A. van Well, S. Adenwalla, G. P. Felcher 'Retrieval of phase information in neutron reflectometry' <i>Phys. Rev. B</i> 52 , (1995), 10831-10833.	http://dx.doi.org/10.1103/PhysRevB.52.10831	1995
32	C. Fermon 'Neutron reflectometry with polarization analysis: A theory and a new spectrometer' <i>Physica B</i> , 213 & 214 , (1995), 910-913.	http://dx.doi.org/10.1016/0921-4526(95)00320-9	1995
33	R. Lipperheide, H. Fiedeldey, H. Leeb, G. Reiss, S.A. Sofianos 'Inversion in neutron specular reflection' <i>Physica B: Condensed Matter</i> , 213-214 , 1995, 914-916.	http://dx.doi.org/10.1016/0921-4526(95)00321-Y	1995
34	J. R. Lu, R. K. Thomas 'Problems in the analysis and interpretation of neutron reflection data' <i>Nuclear Instruments and Methods in Physics Research A</i> , 354 , (1995), 149-163.	http://dx.doi.org/10.1016/0168-9002(94)01037-4	1995
35	W. G. Bouwman, J. S. Pedersen 'Resolution Function for Two-Axis Specular Neutron Reflectivity' <i>J. Appl. Cryst.</i> 29 , (1996), 152-158.	http://dx.doi.org/10.1107/S0021889895012751	1996
36	Wim H. de Jeu, Joseph D. Shindler, Elisabeth A. L. Mol 'The Resolution Function in Diffuse X-ray Reflectivity' <i>J. Appl. Cryst.</i> 29 , (1996), 511-515.	http://dx.doi.org/10.1107/S0021889896001550	1996
37	H. Leeb, J. Kasper, R. Lipperheide 'Determination of the phase in neutron reflectometry by polarization measurements' <i>Physics Letters A</i> , 239 , (1998), 147-152.	http://dx.doi.org/10.1016/S0375-9601(97)00972-9	1998

Seq. No.	Reference	Digital Source	Year
38	C. F. Majkrzak, N. F. Berk 'Exact determination of the phase in neutron reflectometry by variation of the surrounding media' <i>Phys. Rev. B</i> 58 , 15416-15418. (See also erratum, 1999.)	http://dx.doi.org/10.1103/PhysRevB.58.15416	1998
39	D. S. Sivia, J. R. P. Webster 'The Bayesian approach to reflectivity data' <i>Physica B</i> 248 , (1998), 327-337.	http://dx.doi.org/10.1016/S0921-4526(98)00259-2	1998
40	D. L. Windt, 'IMD - Software for modeling the optical properties of multilayer films' <i>Comput. Phys.</i> 12 , (1998), 360-370.	http://dx.doi.org/10.1063/1.168689	1998
41	C. F. Majkrzak, N. F. Berk 'Erratum - Exact determination of the phase in neutron reflectometry by variation of the surrounding media' <i>Phys. Rev. B</i> 60 , (1999) 16211.	http://dx.doi.org/10.1103/PhysRevB.60.16211	1999
42	F. Radu, V. K. Ignatovich 'Generalized matrix method for the transmission of neutrons through multilayer magnetic systems with noncollinear magnetization' <i>Physica B</i> , 267-268 , (1999), 175-180.	http://dx.doi.org/10.1016/S0921-4526(99)00015-0	1999
43	K. A. Welp, C. C. Co, R. P. Wool 'Improved reflectivity fitting using SERF (Spreadsheet Environment Reflectivity Fitting)' <i>Journal of Neutron Research</i> , 8 , (1999), 37-51.	http://dx.doi.org/10.1080/10238169908200235	1999
44	David J. Barlow, Abdul-Mueed Muslim, John R. P. Webster, Jeffrey Penfold, Clare M. Hollinshead, M. Jayne Lawrence 'Molecular modelling of surfactant monolayers under constraints derived from neutron reflectance measurements' <i>Phys. Chem. Chem. Phys.</i> , 2 , (2000), 5208-5213.	http://dx.doi.org/10.1039/B003437L	2000

Seq. No.	Reference	Digital Source	Year
45	H. Leeb, M. Weber, J. Kasper, R. Lipperheide 'Unique analysis of specular reflection data' <i>Physica B</i> , 276-278 , (2000), 75-76.	http://dx.doi.org/10.1016/S0921-4526(99)01354-X	2000
46	H. Leeb, M. Weber, J. Kasper, R. Lipperheide 'Unique magnetization profiles by neutron specular reflection' <i>Surface Science</i> , 454-456 , (2000), 914-917.	http://dx.doi.org/10.1016/S0039-6028(00)00110-2	2000
47	A.-M. Muslim, J. R. P. Webster, J. Penfold, M. J. Lawrence, D. J. Barlow 'SURFISS - A Program for Modeling the Three-Dimensional Structures of Interfacial Surfactant Layers' <i>Langmuir</i> , 16 , (2000), 1189-1195.	http://dx.doi.org/10.1021/la981667q	2000
48	O. H. Seeck, I. D. Kaendler, M. Tolan, K. Shin, M. H. Rafailovich, J. Sokolov, R. Kolb 'Analysis of x-ray reflectivity data from low-contrast polymer bilayer systems using a Fourier method' <i>Applied Physics Letters</i> 76 , (2000), 2713- 2715.	http://dx.doi.org/10.1063/1.126452	2000
49	B. Toperverg, O. Nikonov, V. Lauter-Pasyuk, H. J. Lauter 'Towards 3D polarization analysis in neutron reflectometry' <i>Physica B</i> , 297 , (2001), 169-174.	http://dx.doi.org/10.1016/S0921-4526(00)00866-8	2001
50	Rémi Lazzari ' <i>IsGISAXS</i> : a program for grazing-incidence small-angle X-ray scattering analysis of supported islands' <i>J. Appl. Cryst.</i> 35 , (2002), 406-421.	http://dx.doi.org/10.1107/S0021889802006088	2002
51	I. D. Feranchuk, A. A. Minkevich, A. Ulyanenkoy, 'About non-Gaussian behaviour of the Debye-Waller factor at large scattering vectors' <i>Eur. Phys. J. AP</i> , 24 , (2003), 21-26.	http://dx.doi.org/10.1051/epjap:2003058	2003
52	L. Alianelli, M. Sánchez del Río, R. Felici 'NOP: a new software tool for neutron optics' <i>Physica B</i> , 350 , (2004), e739-e741.	http://dx.doi.org/10.1016/j.physb.2004.03.260	2004

Seq. No.	Reference	Digital Source	Year
53	A. Ulyanenkoy, S. Sobolewski, 'Extended genetic algorithm: application to x-ray analysis' <i>J. Phys. D: Appl. Phys.</i> 38 , (2005), A235-A38.	http://dx.doi.org/10.1088/0022-3727/38/10A/046	2005
54	A. A. van Well, H. Fredrikze 'On the resolution and intensity of a time-of-flight neutron reflectometer' <i>Physica B</i> , 357 , (2005), 204–207.	http://dx.doi.org/10.1016/j.physb.2004.11.058	2005
55	Andrew Nelson 'Co-refinement of multiple-contrast neutron/X-ray reflectivity data using MOTOFIT' <i>J. Appl. Cryst.</i> , (2006), 39 , 273–276.	http://dx.doi.org/10.1107/S0021889806005073	2006
56	A. Ulyanenkoy 'Novel methods and universal software for HRXRD, XRR and GISAXS data interpretation' <i>Applied Surface Science</i> , 253 , (2006), 106-111.	http://dx.doi.org/10.1016/j.apsusc.2006.05.099	2006
57	Matts Björck, Gabriella Andersson 'GenX: an extensible X-ray reflectivity refinement program utilizing differential evolution' <i>J. Appl. Cryst.</i> , (2007). 40 , 1174-1178.	http://dx.doi.org/10.1107/S0021889807045086	2007
58	I. D. Feranchuk, S. I. Feranchuk, A. Ulyanenkoy 'Self-consistent approach to x-ray reflection from rough surfaces' <i>Phys. Rev. B</i> . 75 , (2007), 085414.	http://dx.doi.org/10.1103/PhysRevB.75.085414	2007
59	A. D. Mont, P. A. Kienzle, S. M. Watson, J. A. Borchers, J. Eckert, P. Sparks, S. Moyerman, M. J. Carey 'Determination of Complex Magnetic Structures From Polarized Neutron Reflectivity Data by Flexible Modeling of Depth-Dependent Vector Magnetization' <i>IEEE Transactions on Magnetism</i> , 43 , (2007), 3346-3348.	http://dx.doi.org/10.1109/TMAG.2007.893870	2007
60	F. Salah, B. Harzallah, A. van der Lee 'Data reduction practice in X-ray reflectometry' <i>J. Appl. Cryst.</i> 40 , (2007), 813-819.	http://dx.doi.org/10.1107/S0021889807030403	2007

Seq. No.	Reference	Digital Source	Year
61	D. S. Sivia 'On the kinematic approximation to specular reflectivity data', <i>Philosophical Magazine</i> , 87 , (2007), 1575-1580.	http://dx.doi.org/10.1080/14786430601072283	2007
62	A. van der Lee, F. Salah, B. Harzallah 'A comparison of modern data analysis methods for X-ray and neutron specular reflectivity data' <i>J. Appl. Cryst.</i> 40 , (2007), 820-833.	http://dx.doi.org/10.1107/S0021889807032207	2007
63	P. Colombi, D. K. Agnihotri, V. E. Asadchikov, E. Bontempi, D. K. Bowen, C. H. Chang, L. E. Depero, M. Farnworth, T. Fujimoto, A. Gibaud, M. Jergel, M. Krumrey, T. A. Lafford, A. Lamperti, T. Ma, R. J. Matyi, M. Meduna, S. Milita, K. Sakurai, L. Shabel'nikov, A. Ulyanekov, A. Van der Lee, C. Wiemer 'Reproducibility in X-ray reflectometry: results from the first world-wide round-robin experiment' <i>J. Appl. Cryst.</i> , (2008), 41 , 143-152.	http://dx.doi.org/10.1107/S0021889807051904	2008
64	Stephen M. Danauskas, Dongxu Li, Mati Meron, Binhua Lin and Ka Yee C. Lee 'Stochastic fitting of specular X-ray reflectivity data using StochFit' <i>J. Appl. Cryst.</i> , (2008), 41 , 1187-1193.	http://dx.doi.org/10.1107/S0021889808032445	2008
65	N. F. Berk, C. F. Majkrzak 'Analysis of Multibeam Data for Neutron Reflectivity' <i>Langmuir</i> , 25 , (2009), 4145-4153.	http://dx.doi.org/10.1021/la802780v	2009
66	Jan Ilavsky, Peter R. Jemian, 'Irena: tool suite for modeling and analysis of small-angle scattering' <i>J. Appl. Cryst.</i> 42 , (2009), 347-353.	http://dx.doi.org/10.1107/S0021889809002222	2009

Seq. No.	Reference	Digital Source	Year
67	R. Ashkar, P. Stonaha, A. L. Washington, V. R. Shah, M. R. Fitzsimmons, B. Maranville, C. F. Majkrzak, W. T. Lee, W. L. Schaich, R. Pynn 'Dynamical theory calculations of spin-echo resolved grazing-incidence scattering from a diffraction grating' <i>J. Appl. Cryst.</i> 43 , (2010), 455-465.	http://dx.doi.org/10.1107/S0021889810010642	2010
68	Andrew Nelson 'Motofit – integrating neutron reflectometry acquisition, reduction and analysis into one, easy to use, package' <i>J. Phys.: Conf. Ser.</i> , 251 , (2010), 012094.	http://dx.doi.org/10.1088/1742-6596/251/1/012094	2010
69	Matts Björck 'Fitting with differential evolution: an introduction and evaluation' <i>J. Appl. Cryst.</i> , (2011). 44 , 1198-1204.	http://dx.doi.org/10.1107/S0021889811041446	2011
70	B. J. Kirby, P. A. Kienzle, B. B. Maranville, N. F. Berk, J. Krycka, F. Heinrich, C. F. Majkrzak 'Phase-sensitive specular neutron reflectometry for imaging the nanometer scale composition depth profile of thin-film materials' <i>Current Opinion in Colloid & Interface Science</i> , 17 , (2012), 44-53.	http://dx.doi.org/10.1016/j.cocis.2011.11.001	2012
71	Zin Tun 'Patterson analysis for layer profile determination by neutron or X-ray reflectometry' <i>J. Appl. Cryst.</i> 45 , (2012), 398-405.	http://dx.doi.org/10.1107/S0021889812015075	2012
72	A. R. Wildes 'Inelastic scattering measured on a neutron reflectometer' <i>Eur. Phys. J. Plus</i> , 127 , (2012), 10.	http://dx.doi.org/10.1140/epjp/i2012-12010-6	2012

Seq. No.	Reference	Digital Source	Year
73	Piotr A. Zolnierczuk, Bogdan Vacaliuc, Madhan Sundaram, Andre A. Parizzi, Candice E. Halbert, Michael C. Hoffmann, James F. Browning, John Francis Ankner ““Old wine in new wineskins:” Upgrading the liquids reflectometer instrument user control software at the Spallation Neutron Source’ <i>Future of Instrumentation International Workshop (FIIW) Proceedings</i> Pages: 4 IEEE (2012).	http://dx.doi.org/10.1109/FIIW.2012.6378322	2012
74	Slim T. Chourou, Abhinav Sarje, Xiaoye S. Li, Elaine R. Chan, Alexander Hexemer ‘HipGISAXS: a high-performance computing code for simulating grazing-incidence X-ray scattering data’ <i>J. Appl. Cryst.</i> 46 , (2013), 1781-1795.	http://dx.doi.org/10.1107/S0021889813025843	2013
75	Jeong Soo Lee ‘Evaluation of the Instrument Resolution Effect for Various Neutron Reflectivity Measurement Methods’ <i>New Physics: Sae Mulli</i> 63 , (2013), 783-793.	http://dx.doi.org/10.3938/NPSM.63.783	2013
76	Maheswar Nayak, Gyanendra S. Lodha ‘Approach to combine structural with chemical composition profiles using resonant X-ray scattering’ <i>J. Appl. Cryst.</i> 46 , (2013), 1569-1575.	http://dx.doi.org/10.1107/S0021889813022905	2013
77	Andrew Robert John Nelson, Charles David Dewhurst ‘Towards a detailed resolution smearing kernel for time-of-flight neutron reflectometers’ <i>J. Appl. Cryst.</i> 46 , (2013), 1338-1346.	http://dx.doi.org/10.1107/S0021889813021936	2013

Seq. No.	Reference	Digital Source	Year
78	Yu. O. Volkov, I. V. Kozhevnikov, B. S. Roshchin, E. O. Filatova, V. E. Asadchikov 'Model Approach to Solving the Inverse Problem of X-Ray Reflectometry and Its Application to the Study of the Internal Structure of Hafnium Oxide Films' <i>Crystallography Reports</i> , 58 , (2013), 160-167.	http://dx.doi.org/10.1134/S1063774513010148	2013
79	Yuri Babanov, Yuri Salamatov, Vladimir Ustinov 'A new interpretation of X-ray reflectivity in real space for low contrast multilayer systems I. Mathematical algorithm and numerical simulations' <i>Superlattices and Microstructures</i> 74 , (2014), 100-113.	http://dx.doi.org/10.1016/j.spmi.2014.06.001	2014
80	N. F. Berk 'Determination of the effective transverse coherence of the neutron wave packet as employed in reflectivity investigations of condensed-matter structures. II. Analysis of elastic scattering using energy-gated wave packets with an application to neutron reflection from ruled gratings' <i>Phys. Rev. A</i> 89 , (2014), 033852.	http://dx.doi.org/10.1103/PhysRevA.89.033852	2014
81	Charles F. Majkrzak, Christopher Metting, Brian B. Maranville, Joseph A. Dura, Sushil Satija, Terrence Udovic, Norman F. Berk 'Determination of the effective transverse coherence of the neutron wave packet as employed in reflectivity investigations of condensed-matter structures. I. Measurements' <i>Phys. Rev. A</i> 89 , (2014), 033851.	http://dx.doi.org/10.1103/PhysRevA.89.033851	2014
82	Z. Tun 'Patterson analysis for layer profile determination by neutron or X-ray reflectometry II' <i>J. Appl. Cryst.</i> 47 , (2014), 680-683.	http://dx.doi.org/10.1107/S1600576714001046	2014

Seq. No.	Reference	Digital Source	Year
83	Yuri Babanov, Yuri Salamatov, Vladimir Vasin, Vladimir Ustinov 'The phase problem for X-ray specular reflectivity from thin films: A new approach' <i>Superlattices and Microstructures</i> 82 , (2015), 612-622.	http://dx.doi.org/10.1016/j.spmi.2015.02.035	2015
84	Robert Cubitt, Thomas Saerbeck, Richard A. Campbell, Robert Barker, Philipp Gutfreund 'An improved algorithm for reducing reflectometry data involving divergent beams or non-flat samples' <i>J. Appl. Cryst.</i> 48 , (2015), 2006-2011.	http://dx.doi.org/10.1107/S1600576715019500	2015
85	Yuri Gerelli 'Aurore : new software for neutron reflectivity data analysis' <i>J. Appl. Cryst.</i> 49 , (2016), 330-339.	http://dx.doi.org/10.1107/S1600576716000108	2016
86	Yuri Gerelli 'Aurore : new software for neutron reflectivity data analysis. Corrigendum' <i>J. Appl. Cryst.</i> 49 , (2016), 712.	http://dx.doi.org/10.1107/S1600576716002466	2016
87	A. S. Kirilov 'New Versions of Instrument Tuning Program and Visualization of Spectra for Reflectometers at the IBR 2 Reactor' <i>Physics of Particles and Nuclei Letters</i> , 13 , (2016), 132-139.	http://dx.doi.org/10.1134/S1547477116010118	2016
88	Brian B. Maranville, Brian J. Kirby, Alexander J. Grutter, Paul A. Kienzle, Charles F. Majkrzak, Yaohua Liu, Cindi L. Dennis 'Measurement and modeling of polarized specular neutron reflectivity in large magnetic fields' <i>J. Appl. Cryst.</i> 49 , (2016), 1121-1129.	http://dx.doi.org/10.1107/S1600576716007135	2016