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*Multi-integral representations for associated Legendre and Ferrers functions*

For the associated Legendre and Ferrers functions of the first and second kind, we obtain new multi-derivative and multi-integral representation formulas. The multi-integral representation formulas that we derive for these functions generalize some classical multi-integration formulas. As a result of the determination of these formulae, we compute some interesting special values and integral representations for certain particular combinations of the degree and order including the case where there is symmetry and antisymmetry for the degree and order parameters. As a consequence of our analysis, we obtain some new results for the associated Legendre function of the second kind including parameter values for which this function is identically zero.

This is a Joint work with Howard S. Cohl (NIST)