Diffraction line profile analysis (DLPA) is a powerful characterization tool for the microstructure of crystalline materials. Modern DLPA methods operate by modeling whole diffraction patterns based on microstructural properties and matching the calculated patterns to the measured data. The theoretical profile functions are based on physical models describing the effect of coherently scattering domain size, dislocation structures and planar faulting on the shape of the diffraction profiles.

A general procedure for describing the effect of planar faulting on diffraction line broadening is presented. It is shown, that patterns affected by faulting and twinning can be described by uniform profile functions independent of the crystal structure and faulting type. The effect of the crystal structure and type of faulting is manifested in the characteristic $hkl$ dependence of the parameters of the uniform profile functions. The method is applied to faulting and twinning in face centered cubic (fcc) crystals on the close packed $\{111\}$ planes and to twinning in hexagonal close packed (hcp) crystals on the $\{10.1\}$, $\{11.2\}$, $\{10.2\}$ and $\{11.1\}$ pyramidal planes.

The fcc and hcp case has been incorporated into the extended Convolutional Multiple Whole Profile (eCMWP) DLPA software package. The convolution of the different theoretical profile functions having as parameters the characteristics of the microstructure, together with the experimentally determined instrumental effects on broadening, are fitted by eCMWP to the whole measured diffraction pattern by a non-linear least-squares algorithm, providing as a result detailed information about size, strain and faulting in the investigated material.

Through examples, it will be presented how twin types and frequencies together with dislocation structure and size parameters can be determined in case of cubic and hexagonal materials measured by the high resolution X-ray diffractometer located at the Department of Materials Physics, Eötvös University Budapest, Hungary.

An example will be shown how to determine both the stacking fault and twin boundary frequency in case of plastically deformed TWIP steel measured in-situ using the Spectrometer for Materials Research at Temperature and Stress (SMARTS) time-of-flight neutron diffraction instrument, located at the Los Alamos Neutron Science Center (LANSCE).