Modelling of Light Reflection by Thin Semiconductor Layers

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Simulation of the conditions of extreme spectra formation for multibeam light reflection using the method of complex reflection amplitude hodographs for proper thin films and layers on substrate is proposed. It is shown that:

1. Complex amplitude light reflection hodograph ***r*** by the non-absorbing plate has a circular shape with centre on the real axis *Re* ***r***. The points, where hodograph passes through *Re* ***r*** axis, correspond to light reflection amplitude in spectrum extrema: $R_{\min} = 0$, $R_{\max} = (\mathrm{Re}\,\tilde{r})^2$. The hodograph takes its beginning in the third quadrant of a complex plane that corresponds to first maximum in reflection spectrum with m=1.

2. If the light absorption by the film is present hodograph has a spiral character, the centre of which replaces from the real axis **Re** ***r***. Thus with the amplitude of oscillation interference order increasing the coefficient of reflection decreases. The interference character of the reflection spectrum disappears if hodograph *Re* ***r*** does not cross the axis *Re* ***r***.

3. Period of Fabry-Perot interference spectrum oscillations changes in the region of resonant transitions due to the dispersion of optical refractive and absorption indexes. The spectral shape of long-wave and short-wave regions of resonant interference depends significantly on position (maximum or minimum) where the resonant transition is localised. Nevertheless, at the wavelength which corresponds to the first coincidence of the reflection minima from the films with different thicknesses the following condition is being satisfied:

$$\frac{d_{S2}}{d_{S1}} = 1 + \frac{n}{m}, \quad n = 2,4,6,...,$$

which allows to determine the value of m and, therefore, the film refractive index.