Technische Optik
Praktikum Laser-Triangulation

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09. Juli 2015

Inhaltsverzeichnis

1 Einleitung

$$z = z_{ges} - z_0 \tag{1}$$

$$\sin(90° - \beta + \alpha) = \frac{z_{ges}}{g'} \tag{2}$$
$$\sin(\beta - \alpha) = \frac{d}{g'} \tag{3}$$
$$\sin(90° - \beta) = \frac{z_0}{g_1} \tag{4}$$
$$\sin(\beta) = \frac{d}{g_1} \tag{5}$$

$$z = d \cdot \left(\frac{\sin(90° - (\beta - \alpha))}{\sin(\beta - \alpha)} - \frac{\sin(90° - \beta)}{\sin(\beta)} \right) \tag{6}$$
$$= d \cdot \left(\frac{\cos(\beta - \alpha)}{\sin(\beta - \alpha)} - \frac{\cos(\beta)}{\sin(\alpha)} \right) \tag{7}$$
$$= d \cdot (\cot(\beta - \alpha) - \cot(\beta)) \tag{8}$$

$$\sin(\alpha) = \frac{\Delta p'}{b'} \tag{9}$$
$$\cos(\alpha) = \frac{b}{b'} \tag{10}$$
$$\frac{\sin(\alpha)}{\cos(\alpha)} = \frac{\Delta p'}{b} = \tan(\alpha) \tag{11}$$
$$\alpha = \arctan\left(\frac{\Delta p'}{b} \right) \tag{12}$$

$$\sin(\beta) = \frac{d}{g_1} \tag{13}$$
$$d = g_1 \cdot \sin(\beta) \tag{14}$$

$$z = g_1 \cdot \sin(\beta) \cdot \left\{ \cot\left[\beta - \arctan\left(\frac{\Delta p'}{b} \right) \right] - \cot(\beta) \right\} \tag{15}$$

$$\frac{1}{f} = \frac{1}{b} + \frac{1}{g} \tag{16}$$

$$b = \frac{f \cdot g}{g - f} \tag{17}$$

$$z = g_1 \cdot \sin(\beta) \cdot \left\{ \cot\left[\beta - \arctan\left(\frac{\Delta p'}{\frac{f \cdot g}{g - f}} \right) \right] - \cot(\beta) \right\} \tag{18}$$

2 Versuchsaufbau

3 Auswertung

z/mm	px_g	px_m	z_g/mm	z_m/mm	Δz_g/mm	Δz_m/mm	$\frac{\Delta z_g}{z}$	$\frac{\Delta z_m}{z}$
0	150.93	147	0	0	0	0	0	0
10	241.02	226	9.87	8.64	−0.13	−1.36	−1.32	−13.6
20	329.67	337	19.81	21.09	−0.19	1.09	−0.96	5.44
30	416.47	419	29.77	30.52	−0.23	0.52	−0.77	1.74
40	501.17	501	39.72	40.17	−0.28	0.17	−0.7	0.41
50	583.43	569	49.6	48.33	−0.4	−1.67	−0.8	−3.34
60	664.29	650	59.54	58.25	−0.46	−1.75	−0.77	−2.91
70	743.56	728	69.5	68.02	−0.5	−1.98	−0.72	−2.83
80	820.99	831	79.44	81.26	−0.56	1.26	−0.7	1.57
90	896.68	890	89.38	89.01	−0.62	−0.99	−0.69	−1.1
100	970.41	968	99.27	99.47	−0.73	−0.53	−0.73	−0.53

Tabelle 1: Messwerte

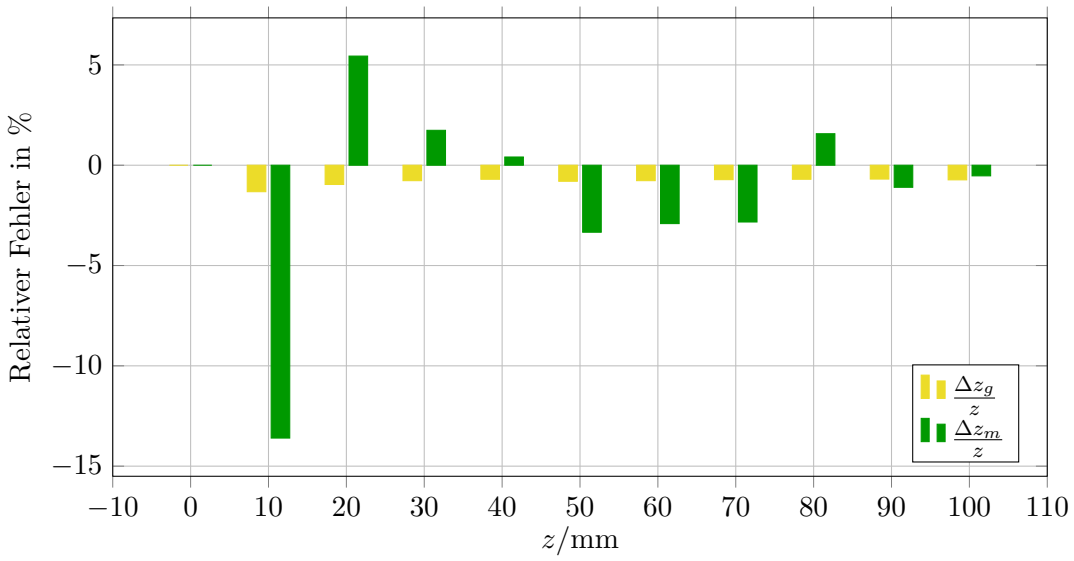

Abbildung 1: Relative Fehler

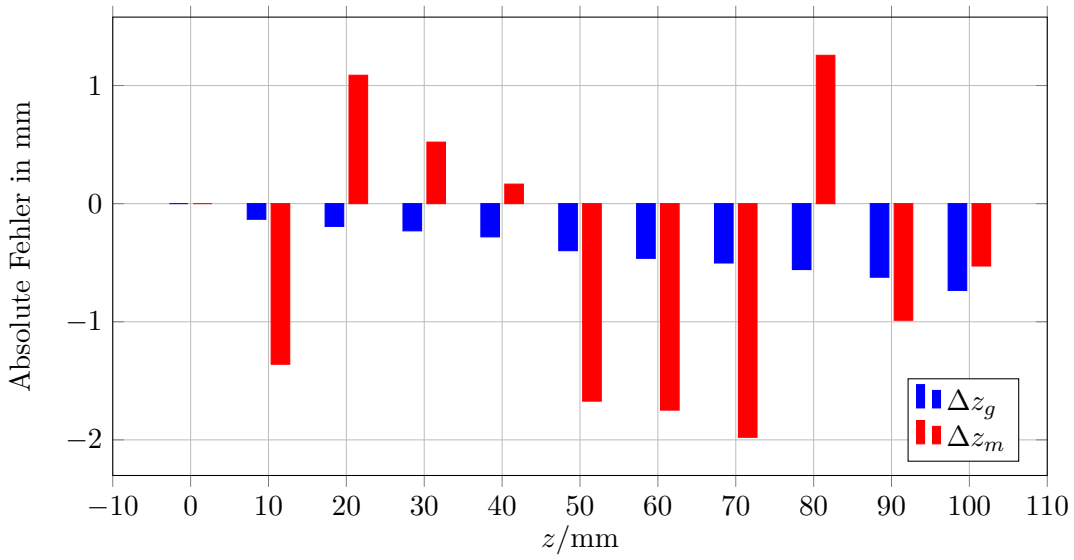

Abbildung 2: Absolute Fehler