

#### 4. Доказательство леммы 5.1.

```
> restart; read("newlib.m"); with(mylib): with(LinearAlgebra):
```

Результат замены с  $s_1=0$  в исходной системе:

```
> zamproc(p1,0,0,0,p2,0,1,0, r1,0,r2,s2):
```

$$\begin{aligned} & p1\ rI^2, 0, 0, 0 \\ & -\frac{r1\ (p1\ r1\ r2 - p2\ rI^2 - r2^2)}{s2}, 2\ r1\ r2, r1\ s2, 0 \end{aligned}$$

$$1) \ b_2=0 \Leftrightarrow r_2=0$$

$$1_1) \ a_2=0 \Leftrightarrow p_2=0$$

```
> zamproc(p1,0,0,0,0,0,1,0, r1,0,0,s2):
```

$$\begin{aligned} & p1\ rI^2, 0, 0, 0 \\ & 0, 0, r1\ s2, 0 \end{aligned}$$

```
> r11 := abs(p1)^(-1/2):
```

```
s21 := p1*r11:
```

```
zamproc(p1,0,0,0,0,0,1,0, r11,0,0,s21):
```

$$\begin{aligned} & \frac{p1}{|p1|}, 0, 0, 0 \\ & 0, 0, \frac{p1}{|p1|}, 0 \end{aligned}$$

$$1_1) \ a_2 \neq 0 \Leftrightarrow p_2 \neq 0$$

```
> zamproc(p1,0,0,0,p2,0,1,0, r1,0,0,s2):
```

$$\begin{aligned} & p1\ rI^2, 0, 0, 0 \\ & \frac{rI^3\ p2}{s2}, 0, r1\ s2, 0 \end{aligned}$$

```
> r11 := abs(p1)^(-1/2):
```

```
s21 := p2*r11/p1:
```

```
zamproc(p1,0,0,0,p2,0,1,0, r11,0,0,s21):
```

$$\begin{aligned} & \frac{p1}{|p1|}, 0, 0, 0 \\ & \frac{p1}{|p1|}, 0, \frac{p2}{|p1|p1}, 0 \end{aligned}$$

$$2) \ a_2=0$$

```
> solve(-p1*r1*r2+p2*r1^2+r2^2, r2);
```

$$\left( \frac{p1}{2} + \frac{\sqrt{pI^2 - 4\ p2}}{2} \right) r1, \left( \frac{p1}{2} - \frac{\sqrt{pI^2 - 4\ p2}}{2} \right) r1$$

```
> r21 := ((1/2)+(1/2)*sqrt(p1^2-4*p2)*abs(p1)^(-1))*p1*r1:
```

```
zamproc(p1,0,0,0,p2,0,1,0, r1,0,r21,s2):
```

$$\begin{aligned} & p1\ rI^2, 0, 0, 0 \\ & -\frac{rI^3\ (pI^2 - 4\ p2)\ (|pI|^2 - pI^2)}{4\ |pI|^3\ s2}, \frac{rI^2\ (|pI| + \sqrt{pI^2 - 4\ p2})\ p1}{|pI|}, r1\ s2, 0 \end{aligned}$$

```
> r11 := abs(p1)^(-1/2):
```

```
s21 := p1*r11:
```

```
r21 := ((1/2)+(1/2)*sqrt(p1^2-4*p2)*abs(p1)^(-1))*p1*r11:
```

```
zamproc(p1,0,0,0,p2,0,1,0, r11,0,r21,s21):
```

$$\begin{aligned} & \frac{p1}{|p1|}, 0, 0, 0 \\ & -\frac{(pI^2 - 4\ p2)\ (|pI|^2 - pI^2)}{4\ |pI|^3\ p1}, \frac{(|pI| + \sqrt{pI^2 - 4\ p2})\ p1}{|pI|^2}, \frac{p1}{|p1|}, 0 \end{aligned}$$

```
> u = (abs(p1)+sqrt(p1^2-4*p2))/abs(p1);
```

$$u = \frac{|pI| + \sqrt{pI^2 - 4\ p2}}{|pI|}$$