

6. Доказательство леммы 5.3.

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

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

$$\begin{aligned} > \text{zamproc}(p1, q1, t1, 0, 0, q2, t2, 0, r1, 0, r2, s2): \\ & \quad \frac{p1 r1^2 + q1 r1 r2 + r2^2 t1, s2 (q1 r1 + 2 r2 t1), t1 s2^2, 0}{s2} \\ & \quad - \frac{(p1 - q2) r1^2 + r2 (q1 - t2) r1 + r2^2 t1) r2}{s2}, q2 r1^2 - r2 (q1 - 2 t2) r1 - 2 r2^2 t1, s2 (r1 t2 - r2 t1), 0 \end{aligned}$$

1) $c_2 = 0$

$$\begin{aligned} > r21 := r1*t2/t1: \\ & \text{zamproc}(p1, q1, t1, 0, 0, q2, t2, 0, r1, 0, r21, s2): \\ & \quad \frac{r1^2 (p1 t1 + q1 t2 + t2^2)}{t1}, r1 s2 (q1 + 2 t2), t1 s2^2, 0 \\ & \quad - \frac{r1^3 ((p1 - q2) t1 + q1 t2) t2}{t1^2 s2}, - \frac{r1^2 (q1 t2 - q2 t1)}{t1}, 0, 0 \end{aligned}$$

$1_1)$ $b_1 = 0 \Leftrightarrow q_1 = -2 t_2$

$$\begin{aligned} > q11 := -2*t2: \\ & \text{zamproc}(p1, q11, t1, 0, 0, q2, t2, 0, r1, 0, r21, s2): \\ & \quad \frac{r1^2 (p1 t1 - t2^2)}{t1}, 0, t1 s2^2, 0 \\ & \quad - \frac{(p1 - q2) t1 - 2 t2^2) r1^3 t2}{t1^2 s2}, \frac{r1^2 (q2 t1 + 2 t2^2)}{t1}, 0, 0 \end{aligned}$$

$1_1^1)$ $a_1 = 0$

$$\begin{aligned} > p11 := t2^2/t1: \\ & \text{zamproc}(p11, q11, t1, 0, 0, q2, t2, 0, r1, 0, r21, s2): \\ & \quad 0, 0, t1 s2^2, 0 \\ & \quad \frac{r1^3 t2 (q2 t1 + t2^2)}{t1^2 s2}, \frac{r1^2 (q2 t1 + 2 t2^2)}{t1}, 0, 0 \end{aligned}$$

$1_1^{1a})$ $b_2 = 0$

$$\begin{aligned} > q21 := -2*t2^2/t1: \\ & \text{zamproc}(p11, q11, t1, 0, 0, q21, t2, 0, r1, 0, r21, s2): \\ & \quad 0, 0, t1 s2^2, 0 \\ & \quad - \frac{r1^3 t2^3}{t1^2 s2}, 0, 0, 0 \end{aligned}$$

$> s21 := 1/sqrt(abs(t1)):$

$$\begin{aligned} & r11 := -t1/(t2*sqrt(abs(t1))): \\ & r22 := r11*t2/t1: \\ & \text{zamproc}(p11, q11, t1, 0, 0, q21, t2, 0, r11, 0, r22, s21): \\ & \quad 0, 0, \frac{t1}{|t1|}, 0 \\ & \quad \frac{t1}{|t1|}, 0, 0, 0 \end{aligned}$$

$1_1^{1b})$ $b_2 \neq 0$

$$\begin{aligned} > r21 := r1*t2/t1: \\ & \text{zamproc}(p11, q11, t1, 0, 0, q2, t2, 0, r1, 0, r21, s2): \\ & \quad 0, 0, t1 s2^2, 0 \\ & \quad \frac{r1^3 t2 (q2 t1 + t2^2)}{t1^2 s2}, \frac{r1^2 (q2 t1 + 2 t2^2)}{t1}, 0, 0 \end{aligned}$$

$> s21 := 1/sqrt(abs(t1)):$

$$\begin{aligned} & r11 := t1*t2^{(-1/3)}*(q2*t1+t2^2)^{(-1/3)}/sqrt(abs(t1)): \\ & r22 := r11*t2/t1: \\ & \text{zamproc}(p11, q11, t1, 0, 0, q2, t2, 0, r11, 0, r22, s21): \\ & \quad 0, 0, \frac{t1}{|t1|}, 0 \\ & \quad \frac{t1}{|t1|}, \frac{t1 (q2 t1 + 2 t2^2)}{t2^{1/3} (q2 t1 + t2^2)^{2/3} |t1|}, 0, 0 \end{aligned}$$

$> u = (q2*t1+2*t2^2)/(t2^(2/3)*(q2*t1+t2^2)^(2/3));$

$$u = \frac{q2 t1 + 2 t2^2}{t2^{2/3} (q2 t1 + t2^2)^{2/3}}$$

```

1^2) b2=0
> q21 := -2*t2^2/t1:
zamproc(p1,q11,t1,0,0,q21,t2,0, r1,0,r21,s2):

$$\frac{rI^2(p1 tI - t2^2)}{tI}, 0, tI s2^2, 0$$


$$-\frac{rI^2 t2 pI}{tI s2}, 0, 0, 0$$


> s21 := 1/sqrt(abs(t1)):
r11 := -abs(t1)^(1/6)*(t2*p1)^(-1/3):
r22 := r11*t2/t1:
zamproc(p1,q11,t1,0,0,q21,t2,0, r11,0,r22,s21):

$$\frac{|tI|^{1/3}(p1 tI - t2^2)(t2 pI)^{1/3}}{t2 pI tI}, 0, \frac{tI}{|tI|}, 0$$


$$\frac{|tI|}{tI}, 0, 0, 0$$


> u = (p1*t1-t2^2)*(t2*p1)^(1/3)/(t2*p1*t1^(2/3));

$$u = \frac{(p1 tI - t2^2)(t2 pI)^{1/3}}{t2 pI tI^2/3}$$


1^3) a2=0
1^3a) t2=0
> zamproc(p1,0,t1,0,0,q2,0,0, r1,0,0,s2):

$$pI rI^2, 0, tI s2^2, 0$$


$$0, q2 rI^2, 0, 0$$


> r11 := 1/sqrt(abs(q2)):
s21 := 1/sqrt(abs(t1)):
zamproc(p1,0,t1,0,0,q2,0,0, r11,0,0,s21):

$$\frac{pI}{|q2|}, 0, \frac{tI}{|tI|}, 0$$


$$0, \frac{q2}{|q2|}, 0, 0$$


> u = p1/q2;

$$u = \frac{pI}{q2}$$


1^3b) t2 ≠ 0, (pI - q2) tI - 2 t2^2=0
> q21 := (p1*t1-2*t2^2)/t1:
zamproc(p1,q11,t1,0,0,q21,t2,0, r1,0,r21,s2):

$$\frac{rI^2(p1 tI - t2^2)}{tI}, 0, tI s2^2, 0$$


$$0, rI^2 pI, 0, 0$$


> r11 := 1/sqrt(abs(p1)):
s21 := 1/sqrt(abs(t1)):
r22 := r11*t2/t1:
zamproc(p1,q11,t1,0,0,q21,t2,0, r11,0,r22,s21):

$$\frac{pI tI - t2^2}{|pI| tI}, 0, \frac{tI}{|tI|}, 0$$


$$0, \frac{pI}{|pI|}, 0, 0$$


> u = (p1*t1-t2^2)/(p1*t1);

$$u = \frac{pI tI - t2^2}{pI tI}$$


1^4) a1, a2, b2 ≠ 0
> zamproc(p1,q11,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$\frac{rI^2(p1 tI - t2^2)}{tI}, 0, tI s2^2, 0$$


$$-\frac{(pI - q2) tI - 2 t2^2}{tI^2 s2} rI^3 t2, \frac{rI^2 (q2 tI + 2 t2^2)}{tI}, 0, 0$$


> s21 := 1/sqrt(abs(t1)):
r11 := -t1*((p1-q2)*t1-2*t2^2)^(-1/3)*t2^(-1/3)/sqrt(abs(t1)):
r22 := r11*t2/t1:
zamproc(p1,q11,t1,0,0,q2,t2,0, r11,0,r22,s21):
```

```


$$\frac{tI(pI tI - tI^2)}{|pI|((pI - q2)tI - 2tI^2)^2 \sqrt[3]{tI^2}} , 0, \frac{tI}{|pI|}, 0$$


$$\frac{tI}{|pI|}, \frac{tI(q2 tI + 2tI^2)}{((pI - q2)tI - 2tI^2)^2 \sqrt[3]{tI^2}} , 0, 0$$


> u = (q2*t1+2*t2^2)/(((p1-q2)*t1-2*t2^2)^(2/3)*t2^(2/3));
v = (p1*t1-t2^2)/(((p1-q2)*t1-2*t2^2)^(2/3)*t2^(2/3));
u =  $\frac{q2 tI + 2tI^2}{((pI - q2)tI - 2tI^2)^2 \sqrt[3]{tI^2}}$ 
v =  $\frac{pI tI - tI^2}{((pI - q2)tI - 2tI^2)^2 \sqrt[3]{tI^2}}$ 

1_2)  $b_1 \neq 0$ 
1_2^1)  $b_2 = 0$ 
> q21 := q1*t2/t1:
zamproc(p1,q1,t1,0,0,q21,t2,0, r1,0,r21,s2):
 $\frac{rI^2(pI tI + qI t2 + tI^2)}{tI}, rI s2 (qI + 2 t2), tI s2^2, 0$ 
 $-\frac{rI^3 t2 pI}{tI s2}, 0, 0, 0$ 

1_2^1a)  $a_1 = 0$ 
> p11 := -(q1+t2)*t2/t1:
zamproc(p11,q1,t1,0,0,q21,t2,0, r1,0,r21,s2):
 $0, rI s2 (qI + 2 t2), tI s2^2, 0$ 
 $\frac{rI^3 t2^2 (qI + t2)}{tI^2 s2}, 0, 0, 0$ 

> s21 := 1/sqrt(abs(t1)):
r11 := t1*(q1+t2)^(-1/3)*t2^(-2/3)/sqrt(abs(t1)):
r22 := r11*t2/t1:
zamproc(p11,q1,t1,0,0,q21,t2,0, r11,0,r22,s21):
 $0, \frac{tI (qI + 2 t2)}{(qI + t2)^{1/3} tI^2 \sqrt[3]{|pI|}}, \frac{tI}{|pI|}, 0$ 
 $\frac{tI}{|pI|}, 0, 0, 0$ 

> u = (q1+2*t2)/((q1+t2)^(1/3)*t2^(2/3));
u =  $\frac{qI + 2 t2}{(qI + t2)^{1/3} tI^2 \sqrt[3]{tI}}$ 

1_2^1b)  $a_1 \neq 0$ 
> s21 := 1/sqrt(abs(t1)):
r11 := -abs(t1)^(1/6)*(t2*p1)^(-1/3): r22 := r11*t2/t1:
zamproc(p1,q1,t1,0,0,q21,t2,0, r11,0,r22,s21):
 $\frac{|pI|^{1/3} (pI tI + qI t2 + tI^2) (t2 pI)^{1/3}}{t2 pI tI}, -\frac{qI + 2 t2}{|pI|^{1/3} (t2 pI)^{1/3}}, \frac{tI}{|pI|}, 0$ 
 $\frac{|pI|}{tI}, 0, 0, 0$ 

> u1 := (p1*t1+q1*t2+t2^2)*(t2*p1)^(1/3)/(t2*p1*t1^(2/3));
v1 := -(q1+2*t2)/(t1*t2*p1)^(1/3);
u1 :=  $\frac{(pI tI + qI t2 + tI^2) (t2 pI)^{1/3}}{t2 pI tI^2 \sqrt[3]{tI}}$ 
v1 :=  $-\frac{qI + 2 t2}{(t2 pI tI)^{1/3}}$ 

> simplify(v1^2-4*u1);
simplify((q1+2*t2)^2-4*(p1*t1+q1*t2+t2^2));
 $\frac{-4 (t2 pI)^{1/3} (pI tI + qI t2 + tI^2) (t2 pI tI)^2 \sqrt[3]{pI t2 tI^2} (qI + 2 t2)^2}{(t2 pI tI)^2 \sqrt[3]{tI^2} t2 pI}$ 
 $-4 pI tI + qI^2$ 

> simplify(v1^3-4*u1*v1-8);
factor(simplify((q1+2*t2)^3+8*t1*p1*t2-4*(q1+2*t2)*(p1*t1+q1*t2+t2^2)));
 $\frac{8 \left( \left( \frac{(qI + 2 t2)^3 tI^2 \sqrt[3]{tI}}{8} + tI^5 \sqrt[3]{pI t2} \right) (t2 pI tI)^{1/3} - \frac{(t2 pI)^{1/3} tI (qI + 2 t2) (pI tI + qI t2 + tI^2)}{2} \right)}{(t2 pI tI)^{1/3} tI^5 \sqrt[3]{tI^2} t2 pI}$ 
 $-qI (4 pI tI - qI^2 - 2 qI t2)$ 

```

$1_2^2) \quad a_1 = 0$
> p11 := -(q1+t2)*t2/t1:
zamproc(p11,q1,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$\frac{r1 s2 (q1 + 2 t2), t1 s2^2, 0}{t1^3 t2 (q2 t1 + t2^2)}, -\frac{r1^2 (q1 t2 - q2 t1)}{t1}, 0, 0$$

> s21 := 1/sqrt(abs(t1)):
r11 := t1/(sqrt(abs(t1))*(q1+2*t2)):
r22 := r11*t2/t1:
zamproc(p11,q1,t1,0,0,q2,t2,0, r11,0,r22,s21):

$$0, \frac{t1}{|t1|}, \frac{t1}{|t1|}, 0$$

$$\frac{t1 t2 (q2 t1 + t2^2)}{|t1| (q1 + 2 t2)^3}, -\frac{t1 (q1 t2 - q2 t1)}{|t1| (q1 + 2 t2)^2}, 0, 0$$

> u = -(q1*t2-q2*t1)/(q1+2*t2)^2;
v = t2*(q2*t1+t2^2)/(q1+2*t2)^3;

$$u = -\frac{q1 t2 - q2 t1}{(q1 + 2 t2)^2}$$

$$v = \frac{t2 (q2 t1 + t2^2)}{(q1 + 2 t2)^3}$$

 $1_2^3) \quad a_2 = 0$
 $1_2^{3a}) \quad t_2 = 0$
> zamproc(p1,q1,t1,0,0,q2,0,0, r1,0,0,s2):

$$p1 r1^2, q1 r1 s2, t1 s2^2, 0$$

$$0, q2 r1^2, 0, 0$$

> r11 := 1/sqrt(abs(q2)):
s21 := q2/(q1*sqrt(abs(q2))):
zamproc(p1,q1,t1,0,0,q2,0,0, r11,0,0,s21):

$$\frac{p1}{|q2|}, \frac{q2}{|q2|}, \frac{t1 q2^2}{|q2| q1^2}, 0$$

$$0, \frac{q2}{|q2|}, 0, 0$$

> u = p1/q2;
v = t1*q2/q1^2;

$$u = \frac{p1}{q2}$$

$$v = \frac{t1 q2}{q1^2}$$

 $1_2^{3b}) \quad t_2 \neq 0$
> p11 := (q2*t1-q1*t2)/t1:
zamproc(p11,q1,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$\frac{r1^2 (q2 t1 + t2^2)}{t1}, r1 s2 (q1 + 2 t2), t1 s2^2, 0$$

$$0, -\frac{r1^2 (q1 t2 - q2 t1)}{t1}, 0, 0$$

> r11 := sqrt(abs(t1))*abs(q2*t1-q1*t2)^(-1/2):
r22 := r11*t2/t1:
s21 := (q2*t1-q1*t2)*sqrt(abs(t1))/(t1*(q1+2*t2)*abs(q2*t1-q1*t2)^(1/2)):
zamproc(p11,q1,t1,0,0,q2,t2,0, r11,0,r22,s21):

$$\frac{(q2 t1 + t2^2) \left| \frac{t1}{q1 t2 - q2 t1} \right|}{t1}, -\frac{(q1 t2 - q2 t1) \left| \frac{t1}{q1 t2 - q2 t1} \right|}{t1}, \frac{(q1 t2 - q2 t1)^2 \left| \frac{t1}{q1 t2 - q2 t1} \right|}{t1 (q1 + 2 t2)^2}, 0$$

$$0, -\frac{(q1 t2 - q2 t1) \left| \frac{t1}{q1 t2 - q2 t1} \right|}{t1}, 0, 0$$

> u = (q2*t1+t2^2)/(q2*t1-q1*t2);
v = (q2*t1-q1*t2)/(q1+2*t2)^2;

$$u = \frac{q2 t1 + t2^2}{-q1 t2 + q2 t1}$$

$$v = \frac{-q1 t2 + q2 t1}{(q1 + 2 t2)^2}$$

2) $c_2 \neq 0, b_1 = 0$

```
> r21 := -q1*r1/(2*t1):
zamproc(p1,q1,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$\frac{rl^2(4pltl - ql^2)}{4tl}, 0, tl s2^2, 0$$


$$\frac{rl^3 \left( -\frac{ql^2}{4} + \frac{ql t2}{2} + (pl - q2) tl \right) ql}{2 tl^2 s2}, -\frac{rl^2 (ql t2 - q2 tl)}{tl}, \frac{rl s2 (ql + 2 t2)}{2}, 0$$

```

2₁) $b_2 = 0$

```
> q21 := q1*t2/t1:
zamproc(p1,q1,t1,0,0,q21,t2,0, r1,0,r21,s2):

$$\frac{rl^2(4pltl - ql^2)}{4tl}, 0, tl s2^2, 0$$


$$\frac{ql rl^3 (4pl tl - ql^2 - 2 ql t2)}{8 tl^2 s2}, 0, \frac{rl s2 (ql + 2 t2)}{2}, 0$$

```

2₁) $a_1 = 0$

```
> p11 := q1^2/(4*t1):
zamproc(p11,q1,t1,0,0,q21,t2,0, r1,0,r21,s2):

$$0, 0, tl s2^2, 0$$


$$-\frac{rl^3 t2 ql^2}{4 tl^2 s2}, 0, \frac{rl s2 (ql + 2 t2)}{2}, 0$$

```

```
> s21 := 1/sqrt(abs(t1)):
r11 := -t1^4^(1/3)/(q1^(2/3)*t2^(1/3)*sqrt(abs(t1))):
r22 := -q1*r11/(2*t1):
zamproc(p11,q1,t1,0,0,q21,t2,0, r11,0,r22,s21):

$$0, 0, \frac{tl}{|tl|}, 0$$


$$\frac{tl}{|tl|}, 0, -\frac{tl 2^{2/3} (ql + 2 t2)}{2 ql^{2/3} t2^{1/3} |tl|}, 0$$

```

```
> u = -2^(2/3)*(q1+2*t2)/(2*q1^(2/3)*t2^(1/3));

$$u = -\frac{2^{2/3} (ql + 2 t2)}{2 ql^{2/3} t2^{1/3}}$$

```

2₁²) $a_2 = 0$

2₁^{2a}) $q_1 = 0$

```
> zamproc(p1,0,t1,0,0,0,t2,0, r1,0,0,s2):

$$p1 rl^2, 0, tl s2^2, 0$$


$$0, 0, rl t2 s2, 0$$

```

```
> s21 := 1/sqrt(abs(t1)):
r11 := t1/(t2*sqrt(abs(t1))):
zamproc(p1,0,t1,0,0,0,t2,0, r11,0,0,s21):

$$\frac{p1 tl^2}{|tl| t2^2}, 0, \frac{tl}{|tl|}, 0$$


$$0, 0, \frac{tl}{|tl|}, 0$$

```

> u = p1*t1/t2^2;

$$u = \frac{p1 tl}{t2^2}$$

2₁^{2b}) $q_1 \neq 0$

```
> p11 := q1*(q1+2*t2)/(4*t1):
zamproc(p11,q1,t1,0,0,q21,t2,0, r1,0,r21,s2):

$$\frac{ql rl^2 t2}{2 tl}, 0, tl s2^2, 0$$


$$0, 0, \frac{rl s2 (ql + 2 t2)}{2}, 0$$

```

```
> s21 := 1/sqrt(abs(t1)):
r11 := 2*t1/((q1+2*t2)*sqrt(abs(t1))):
r22 := -q1*r11/(2*t1):
zamproc(p11,q1,t1,0,0,q21,t2,0, r11,0,r22,s21):

$$\frac{2 t2 tl ql}{|tl| (ql + 2 t2)^2}, 0, \frac{tl}{|tl|}, 0$$

```

```

> u = 2*t2*q1/(q1+2*t2)^2;

$$u = \frac{2 t2 q1}{(q1 + 2 t2)^2}$$

213)  $c_2, a_1, a_2 \neq 0$ 
> zamproc(p1,q1,t1,0,0,q21,t2,0, r1,0,r21,s2):

$$\frac{r l^2 (4 p1 t1 - q l^2)}{4 t1}, 0, t1 s2^2, 0$$


$$\frac{q1 r l^3 (4 p1 t1 - q l^2 - 2 q1 t2)}{8 t1^2 s2}, 0, \frac{r1 s2 (q1 + 2 t2)}{2}, 0$$

> s21 := 1/sqrt(abs(t1)):
r11 := 2*t1/(sqrt(abs(t1))*q1^(1/3)*(4*p1*t1-q1^2-2*q1*t2)^(1/3)):
r22 := -q1*r11/(2*t1):
zamproc(p1,q1,t1,0,0,q21,t2,0, r11,0,r22,s21):

$$\frac{t1 (4 p1 t1 - q l^2)}{|t1| q l^2 \sqrt[3]{(4 p1 t1 - q l^2 - 2 q1 t2)^2} \sqrt[3]{}}, 0, \frac{t1}{|t1|}, 0$$


$$\frac{t1}{|t1|}, 0, \frac{t1 (q1 + 2 t2)}{|t1| q l^1 \sqrt[3]{(4 p1 t1 - q l^2 - 2 q1 t2)^1} \sqrt[3]}, 0$$

> u1 := (q1+2*t2)/(q1^(1/3)*(4*p1*t1-q1^2-2*q1*t2)^(1/3));
v1 := (4*p1*t1-q1^2)/(q1^(2/3)*(4*p1*t1-q1^2-2*q1*t2)^(2/3));

$$u1 := \frac{q1 + 2 t2}{q1^{1/3} (4 p1 t1 - q l^2 - 2 q1 t2)^{1/3}}$$


$$v1 := \frac{4 p1 t1 - q l^2}{q l^2 \sqrt[3]{(4 p1 t1 - q l^2 - 2 q1 t2)^2} \sqrt[3]}$$

> simplify(v1+u1^2);

$$\frac{4 (p1 t1 + q1 t2 + t2^2)}{q l^2 \sqrt[3]{(4 p1 t1 - q l^2 - 2 q1 t2)^2} \sqrt[3]}$$

Сведение  $NSF_{20}^4$  к предшествующим.
> zamproc(v,0,1,0,1,0,u,0, r1,0,u*r1,s2):

$$\frac{r l^2 (u^2 + v), 2 u r l s2, s2^2, 0}{- \frac{r l^3 (u v - 1)}{s2}, 0, 0, 0}$$

v=-u2
> zamproc(-u^2,0,1,0,1,0,u,0, r1,0,u*r1,s2):

$$0, 2 u r l s2, s2^2, 0$$


$$\frac{r l^3 (u + 1) (u^2 - u + 1)}{s2}, 0, 0, 0$$

> s21 := 1:
r11 := ((u+1)*(u^2-u+1))^(1/3):
zamproc(-u^2,0,1,0,1,0,u,0, r11,0,u*r11,s21):

$$0, \frac{2 u}{((u + 1) (u^2 - u + 1))^{\frac{1}{3}}}, 1, 0$$


$$1, 0, 0, 0$$

v ≠ -u2
> s21 := 1:
r11 := -(u*v-1)^(1/3):
zamproc(v,0,1,0,1,0,u,0, r11,0,u*r11,s21):

$$\frac{u^2 + v}{(u v - 1)^{\frac{2}{3}}}, - \frac{2 u}{(u v - 1)^{\frac{1}{3}}}, 1, 0$$


$$1, 0, 0, 0$$

22)  $a_1 = 0$ 
> p11 := q1^2/(4*t1):
zamproc(p11,q1,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$0, 0, t1 s2^2, 0$$


$$\frac{r l^3 q1 (q1 t2 - 2 q2 t1)}{4 t1^2 s2}, - \frac{r l^2 (q1 t2 - q2 t1)}{t1}, \frac{r1 s2 (q1 + 2 t2)}{2}, 0$$

> s21 := 1/sqrt(abs(t1)):
r11 := 4^(1/3)*t1/(sqrt(abs(t1))*q1^(1/3)*(q1*t2-2*q2*t1)^(1/3)):
```

```

r22 := -q1*r11/(2*t1):
zamproc(p11,q1,t1,0,0,q2,t2,0, r11,0,r22,s21):

$$\frac{t1}{|t1|}, 0, 0, \frac{t1}{|t1|}, 0$$


$$-\frac{2 t1 (q1 t2 - q2 t1) 2^{1/3}}{|t1| q1^2 3^{1/3} (q1 t2 - 2 q2 t1)^2 3^{1/3}}, \frac{2^{2/3} t1 (q1 + 2 t2)}{2 |t1| q1^{1/3} (q1 t2 - 2 q2 t1)^{1/3}}, 0$$

> u = 2^(2/3)*(q1+2*t2)/(2*q1^(1/3)*(q1*t2-2*q2*t1)^(1/3));
v = -2*(q1*t2-q2*t1)*2^(1/3)/(q1^(2/3)*(q1*t2-2*q2*t1)^(2/3));

$$u = \frac{2^{2/3} (q1 + 2 t2)}{2 q1^{1/3} (q1 t2 - 2 q2 t1)^{1/3}}$$


$$v = -\frac{2 (q1 t2 - q2 t1) 2^{1/3}}{q1^2 3^{1/3} (q1 t2 - 2 q2 t1)^2 3^{1/3}}$$

23) a2=0
231) q1=0
> zamproc(p1,0,t1,0,0,q2,t2,0, r1,0,0,s2):

$$p1 r1^2, 0, t1 s2^2, 0$$


$$0, q2 r1^2, t2 r1 s2, 0$$

> s21 := 1/sqrt(abs(t1)):
r11 := t1/(t2*sqrt(abs(t1))):
zamproc(p1,0,t1,0,0,q2,t2,0, r11,0,0,s21):

$$\frac{p1 t1^2}{|t1| t2^2}, 0, \frac{t1}{|t1|}, 0$$


$$0, \frac{q2 t1^2}{t2^2 |t1|}, \frac{t1}{|t1|}, 0$$

> u = q2*t1/t2^2;
v = p1*t1/t2^2;

$$u = \frac{q2 t1}{t2^2}$$


$$v = \frac{p1 t1}{t2^2}$$

232) q1 ≠ 0
> p11 := q1*(q1-2*t2)*(4*t1)^(-1)+q2:
zamproc(p11,q1,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$-\frac{r1^2 (q1 t2 - 2 q2 t1)}{2 t1}, 0, t1 s2^2, 0$$


$$0, -\frac{r1^2 (q1 t2 - q2 t1)}{t1}, \frac{r1 s2 (q1 + 2 t2)}{2}, 0$$

> s21 := 1/sqrt(abs(t1)):
r11 := 2*t1/(sqrt(abs(t1))* (q1+2*t2)):
r22 := -q1*r11/(2*t1):
zamproc(p11,q1,t1,0,0,q2,t2,0, r11,0,r22,s21):

$$-\frac{2 (q1 t2 - 2 q2 t1) t1}{|t1| (q1 + 2 t2)^2}, 0, \frac{t1}{|t1|}, 0$$


$$0, -\frac{4 t1 (q1 t2 - q2 t1)}{|t1| (q1 + 2 t2)^2}, \frac{t1}{|t1|}, 0$$

> u = -4*(q1*t2-q2*t1)/(q1+2*t2)^2;
v = -(2*(q1*t2-2*q2*t1))/(q1+2*t2)^2;

$$u = -\frac{4 (q1 t2 - q2 t1)}{(q1 + 2 t2)^2}$$


$$v = -\frac{2 (q1 t2 - 2 q2 t1)}{(q1 + 2 t2)^2}$$

3) a1=0
> solve(p1*r1^2+q1*r1*s2+r2^2*t1, r2);

$$\frac{(-q1 + \sqrt{-4 p1 t1 + q1^2}) r1}{2 t1}, -\frac{(q1 + \sqrt{-4 p1 t1 + q1^2}) r1}{2 t1}$$

> r21 := (-q1+sqrt(-4*p1*t1+q1^2))*r1/(2*t1):
zamproc(p1,q1,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$0, r1 s2 \sqrt{-4 p1 t1 + q1^2}, t1 s2^2, 0$$


```

$$\frac{rl^3(-q1 + \sqrt{-4p1tl + ql^2})(t2\sqrt{-4p1tl + ql^2} - q1t2 + 2q2tl)}{4tl^2s2},$$

$$\frac{rl^2(q1\sqrt{-4p1tl + ql^2} + 2t2\sqrt{-4p1tl + ql^2} + 4p1tl - ql^2 - 2q1t2 + 2q2tl)}{2tl}, -\frac{rls2(-2t2 - q1 + \sqrt{-4p1tl + ql^2})}{2}, 0$$

$\geq r22 := (-q1 - \text{sqrt}(-4*p1*t1 + q1^2)) * r1 / (2*t1);$
 $\text{zamproc}(p1, q1, t1, 0, 0, q2, t2, 0, r1, 0, r22, s2);$
 $0, -rls2\sqrt{-4p1tl + ql^2}, tl s2^2, 0$

$$\frac{rl^3(q1 + \sqrt{-4p1tl + ql^2})(t2\sqrt{-4p1tl + ql^2} + q1t2 - 2q2tl)}{4tl^2s2},$$

$$-\frac{rl^2(-4p1tl + ql^2 + q1\sqrt{-4p1tl + ql^2} + 2t2\sqrt{-4p1tl + ql^2} + 2q1t2 - 2q2tl)}{2tl}, \frac{rls2(2t2 + q1 + \sqrt{-4p1tl + ql^2})}{2}, 0$$

$\geq 3_1) b_2 = 0$

$\geq q21 := (q1^2 + 2*q1*t2 - 4*p1*t1 - (q1 + 2*t2) * \text{sqrt}(-4*p1*t1 + q1^2)) / (2*t1);$
 $\text{zamproc}(p1, q1, t1, 0, 0, q21, t2, 0, r1, 0, r21, s2);$
 $0, rls2\sqrt{-4p1tl + ql^2}, tl s2^2, 0$

$$-\frac{rl^3(-q1 + \sqrt{-4p1tl + ql^2})(q1\sqrt{-4p1tl + ql^2} + t2\sqrt{-4p1tl + ql^2} + 4p1tl - ql^2 - q1t2)}{4tl^2s2}, 0, -\frac{rls2(-2t2 - q1 + \sqrt{-4p1tl + ql^2})}{2}, 0$$

$\geq s21 := 1/\text{sqrt}(\text{abs}(t1));$
 $r11 := t1 / (\text{sqrt}(\text{abs}(t1)) * \text{sqrt}(-4*p1*t1 + q1^2));$
 $r21 := (-q1 + \text{sqrt}(-4*p1*t1 + q1^2)) * r11 / (2*t1);$
 $\text{zamproc}(p1, q1, t1, 0, 0, q21, t2, 0, r11, 0, r21, s21);$
 $0, \frac{tl}{|tl|}, \frac{tl}{|tl|}, 0$

$$-\frac{tl(-q1 + \sqrt{-4p1tl + ql^2})(q1\sqrt{-4p1tl + ql^2} + t2\sqrt{-4p1tl + ql^2} + 4p1tl - ql^2 - q1t2)}{4|tl|(-4p1tl + ql^2)^{3/2}}, 0, -\frac{(-2t2 - q1 + \sqrt{-4p1tl + ql^2})tl}{2\sqrt{-4p1tl + ql^2}|tl|}, 0$$

$\geq u = -(-q1 - 2*t2 + \text{sqrt}(-4*p1*t1 + q1^2)) / (2*\text{sqrt}(-4*p1*t1 + q1^2));$
 $v = -(-q1 + \text{sqrt}(-4*p1*t1 + q1^2)) * (q1 * \text{sqrt}(-4*p1*t1 + q1^2) + t2 * \text{sqrt}(-4*p1*t1 + q1^2) + 4*p1*t1 - q1^2 - q1*t2) / (4 * (-4*p1*t1 + q1^2)^{(3/2)});$
 $u = -\frac{-2t2 - q1 + \sqrt{-4p1tl + ql^2}}{2\sqrt{-4p1tl + ql^2}}$
 $v = -\frac{(-q1 + \sqrt{-4p1tl + ql^2})(q1\sqrt{-4p1tl + ql^2} + t2\sqrt{-4p1tl + ql^2} + 4p1tl - ql^2 - q1t2)}{4(-4p1tl + ql^2)^{3/2}}$

$\geq q22 := (q1^2 + 2*q1*t2 - 4*p1*t1 + (q1 + 2*t2) * \text{sqrt}(-4*p1*t1 + q1^2)) / (2*t1);$
 $\text{zamproc}(p1, q1, t1, 0, 0, q22, t2, 0, r1, 0, r22, s2);$
 $0, -rls2\sqrt{-4p1tl + ql^2}, tl s2^2, 0$

$$-\frac{rl^3(q1 + \sqrt{-4p1tl + ql^2})(q1\sqrt{-4p1tl + ql^2} + t2\sqrt{-4p1tl + ql^2} - 4p1tl + ql^2 + q1t2)}{4tl^2s2}, 0, \frac{rls2(2t2 + q1 + \sqrt{-4p1tl + ql^2})}{2}, 0$$

$\geq s21 := 1/\text{sqrt}(\text{abs}(t1));$
 $r12 := -t1 / (\text{sqrt}(\text{abs}(t1)) * \text{sqrt}(-4*p1*t1 + q1^2));$
 $r22 := (-q1 - \text{sqrt}(-4*p1*t1 + q1^2)) * r12 / (2*t1);$
 $\text{zamproc}(p1, q1, t1, 0, 0, q22, t2, 0, r12, 0, r22, s21);$
 $0, \frac{tl}{|tl|}, \frac{tl}{|tl|}, 0$

$$-\frac{tl(q1 + \sqrt{-4p1tl + ql^2})(q1\sqrt{-4p1tl + ql^2} + t2\sqrt{-4p1tl + ql^2} - 4p1tl + ql^2 + q1t2)}{4|tl|(-4p1tl + ql^2)^{3/2}}, 0, -\frac{tl(2t2 + q1 + \sqrt{-4p1tl + ql^2})}{2|tl|\sqrt{-4p1tl + ql^2}}, 0$$

$\geq u = -(q1 + 2*t2 + \text{sqrt}(-4*p1*t1 + q1^2)) / (2*\text{sqrt}(-4*p1*t1 + q1^2));$
 $v = (q1 + \text{sqrt}(-4*p1*t1 + q1^2)) * (q1 * \text{sqrt}(-4*p1*t1 + q1^2) + t2 * \text{sqrt}(-4*p1*t1 + q1^2) - 4*p1*t1 + q1^2 + q1*t2) / (4 * (-4*p1*t1 + q1^2)^{(3/2)});$
 $u = -\frac{2t2 + q1 + \sqrt{-4p1tl + ql^2}}{2\sqrt{-4p1tl + ql^2}}$
 $v = \frac{(q1 + \sqrt{-4p1tl + ql^2})(q1\sqrt{-4p1tl + ql^2} + t2\sqrt{-4p1tl + ql^2} - 4p1tl + ql^2 + q1t2)}{4(-4p1tl + ql^2)^{3/2}}$

4) $b_2 = 0$

4₁) $q_2 = 0$

4₁¹) $r_2 = 0$

> zamproc(p1, q1, t1, 0, 0, 0, t2, 0, r1, 0, 0, s2) :

$$\begin{aligned} & r1^2 p1, q1 r1 s2, t1 s2^2, 0 \\ & \quad 0, 0, t2 r1 s2, 0 \end{aligned}$$

> s21 := 1/sqrt(abs(t1)) : r11 := t1/(t2*sqrt(abs(t1))) :

zamproc(p1, q1, t1, 0, 0, 0, t2, 0, r11, 0, 0, s21) :

$$\begin{aligned} & \frac{p1 t1^2}{|t1| t2^2}, \frac{q1 t1}{t2 |t1|}, \frac{t1}{|t1|}, 0 \\ & \quad 0, 0, \frac{t1}{|t1|}, 0 \end{aligned}$$

> u = p1*t1/t2^2; v = q1/t2;

$$\begin{aligned} u &= \frac{p1 t1}{t2^2} \\ v &= \frac{q1}{t2} \end{aligned}$$

4₁²) $r_2 \neq 0$

> r21 := (2*t2-q1)*r1*(2*t1)^(-1) :

zamproc(p1, q1, t1, 0, 0, 0, t2, 0, r1, 0, r21, s2) :

$$\begin{aligned} & \frac{r1^2 (4 p1 t1 - q1^2 + 4 t2^2)}{4 t1}, 2 t2 r1 s2, t1 s2^2, 0 \\ & \frac{(q1 - 2 t2) r1^3 (4 p1 t1 - q1^2 + 2 q1 t2)}{8 t1^2 s2}, 0, \frac{q1 r1 s2}{2}, 0 \end{aligned}$$

> p11 := q1*(q1-2*t2)/(4*t1) :

zamproc(p11, q1, t1, 0, 0, 0, t2, 0, r1, 0, r21, s2) :

$$\begin{aligned} & -\frac{(q1 - 2 t2) r1^2 t2}{2 t1}, 2 t2 r1 s2, t1 s2^2, 0 \\ & \quad 0, 0, \frac{q1 r1 s2}{2}, 0 \end{aligned}$$

> s21 := 1/sqrt(abs(t1)) :

r11 := 2*t1/(sqrt(abs(t1))*q1) :

r21 := (2*t2-q1)*r11*(2*t1)^(-1) :

zamproc(p11, q1, t1, 0, 0, 0, t2, 0, r11, 0, r21, s21) :

$$\begin{aligned} & -\frac{2 (q1 - 2 t2) t1 t2}{|t1| q1^2}, \frac{4 t1 t2}{|t1| q1}, \frac{t1}{|t1|}, 0 \\ & \quad 0, 0, \frac{t1}{|t1|}, 0 \end{aligned}$$

> u = -(2*(q1-2*t2))*t2/q1^2; v = 4*t2/q1;

$$\begin{aligned} u &= -\frac{2 (q1 - 2 t2) t2}{q1^2} \\ v &= \frac{4 t2}{q1} \end{aligned}$$

4₂) $q_2 \neq 0$

> solve(q2*r1^2-r2*(q1-2*t2)*r1-2*r2^2*t1, r2) ;

$$\begin{aligned} & \frac{(-q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2}) r1}{4 t1}, -\frac{(q1 - 2 t2 + \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2}) r1}{4 t1} \end{aligned}$$

> r21 := (-q1+2*t2+sqrt(q1^2-4*q1*t2+8*t1*q2+4*t2^2))*r1/(4*t1) :

zamproc(p1, q1, t1, 0, 0, q2, t2, 0, r1, 0, r21, s2) :

$$\begin{aligned} & \frac{r1^2 (q1 \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2} + 2 t2 \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2} + 8 p1 t1 - q1^2 + 4 t1 q2 + 4 t2^2)}{8 t1}, \end{aligned}$$

$$\begin{aligned} & \frac{r1 s2 (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2})}{2}, t1 s2^2, 0 \end{aligned}$$

$$\begin{aligned} & -\frac{(-q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2}) r1^3 (q1 \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2} + 8 p1 t1 - q1^2 + 2 q1 t2 - 4 t1 q2)}{32 t1^2 s2}, 0, \end{aligned}$$

$$\begin{aligned} & -\frac{r1 s2 (-2 t2 - q1 + \sqrt{q1^2 - 4 q1 t2 + 8 t1 q2 + 4 t2^2})}{4}, 0 \end{aligned}$$

> r22 := (-q1+2*t2-sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))*r1/(4*t1) :

```

zamproc(p1,q1,t1,0,0,q2,t2,0, r1,0,r22,s2) :

$$-\frac{r1^2 (q1 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} + 2 t2 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} - 8 p1 t1 + q1^2 - 4 t1 q2 - 4 t2^2)}{8 t1},$$


$$-\frac{r1 s2 (-2 t2 - q1 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{2}, t1 s2^2, 0$$


$$-\frac{(q1 - 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2}) r1^3 (q1 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} - 8 p1 t1 + q1^2 - 2 q1 t2 + 4 t1 q2)}{32 t1^2 s2}, 0,$$


$$\frac{r1 s2 (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{4}, 0$$

4)  $a_2 = 0$ 
> p11 := (q1^2-2*q1*t2+4*q2*t1-q1*sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))/(8*t1):
zamproc(p11,q1,t1,0,0,q2,t2,0, r1,0,r21,s2):

$$\frac{r1^2 (t2 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} - q1 t2 + 4 t1 q2 + 2 t2^2)}{4 t1}, \frac{r1 s2 (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{2}, t1 s2^2, 0$$


$$0, 0, -\frac{r1 s2 (-2 t2 - q1 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{4}, 0$$

> s21 := 1/sqrt(abs(t1)):
r11 := 4*t1/(sqrt(abs(t1)) * (2*t2+q1-sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))) :
r21 := (-q1+2*t2+sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))*r11/(4*t1):
zamproc(p11,q1,t1,0,0,q2,t2,0, r11,0,r21,s21):

$$\frac{4 (t2 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} - q1 t2 + 4 t1 q2 + 2 t2^2) t1}{\mu|I| (-2 t2 - q1 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})^2}, \frac{2 t1 (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{\mu|I| (2 t2 + q1 - \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}, \frac{t1}{\mu|I|}, 0$$


$$0, 0, \frac{t1}{\mu|I|}, 0$$

> u = (4*(t2*sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2)-q1*t2+4*t1*q2+2*t2^2))/(-2*t2-q1+sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))^2;
v = 2*(q1+2*t2+sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))/(2*t2+q1-sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2));

$$u = \frac{4 (t2 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} - q1 t2 + 4 t1 q2 + 2 t2^2)}{(-2 t2 - q1 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})^2}$$


$$v = \frac{2 (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{2 t2 + q1 - \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2}}$$

> p12 := (q1^2-2*q1*t2+4*q2*t1+q1*sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))/(8*t1):
zamproc(p12,q1,t1,0,0,q2,t2,0, r1,0,r22,s2):

$$-\frac{r1^2 (t2 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} + q1 t2 - 4 t1 q2 - 2 t2^2)}{4 t1}, -\frac{r1 s2 (-2 t2 - q1 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{2}, t1 s2^2, 0$$


$$0, 0, \frac{r1 s2 (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{4}, 0$$

> s21 := 1/sqrt(abs(t1)):
r12 := 4*t1/(sqrt(abs(t1)) * (q1+2*t2+sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))) :
r22 := (-q1+2*t2-sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))*r12/(4*t1):
zamproc(p12,q1,t1,0,0,q2,t2,0, r12,0,r22,s21):

$$\frac{4 (t2 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} + q1 t2 - 4 t1 q2 - 2 t2^2) t1}{\mu|I| (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})^2}, \frac{2 t1 (2 t2 + q1 - \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{\mu|I| (q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}, \frac{t1}{\mu|I|}, 0$$


$$0, 0, \frac{t1}{\mu|I|}, 0$$

> u = -(4*(t2*sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2)+q1*t2-4*t1*q2-2*t2^2))/(q1+2*t2+sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))^2;
v = 2*(2*t2+q1-sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2))/(2*t2+q1-sqrt(q1^2-4*q1*t2+8*q2*t1+4*t2^2));

$$u = -\frac{4 (t2 \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2} + q1 t2 - 4 t1 q2 - 2 t2^2)}{(q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})^2}$$


$$v = \frac{2 (2 t2 + q1 - \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2})}{q1 + 2 t2 + \sqrt{q1^2 - 4 q1 t1 + 8 t1 q2 + 4 t2^2}}$$

5)  $a_2 = 0$ 
> zamproc(p1,q1,t1,0,0,q2,t2,0, r1,0,0,s2):

```

```

p1 r1 l^2, q1 r1 s2, t1 s2^2, 0
0, q2 r1 l^2, t2 r1 s2, 0
> r11 := 1/sqrt(abs(q2));
s21 := q2/(t2*sqrt(abs(q2)));
zamproc(p1,q1,t1,0,0,q2,t2,0, r11,0,0,s21):
    
$$\frac{p1}{|q2|}, \frac{q1 q2}{|q2| t2}, \frac{t1 q2^2}{|q2| t2^2}, 0$$

    
$$0, \frac{q2}{|q2|}, \frac{q2}{|q2|}, 0$$

> u = p1/q2;
v = q1/t2;
w = t1*q2/t2^2;
    
$$u = \frac{p1}{q2}$$

    
$$v = \frac{q1}{t2}$$

    
$$w = \frac{t1 q2}{t2^2}$$


```

Сведение к системам из II части списка 2.1.

Результат замены с $r_1 = s_1$ в исходной системе:

```

> M := zamproc(p1,q1,t1,0,0,q2,t2,0, s1,s1,r2,s2):

$$\frac{-s1^2 s2 p1 - s1 s2 r2 q1 + q2 s1^2 r2 + t2 s1 r2^2 - r2^2 s2 t1}{r2 - s2},$$


$$\frac{(-s1 q1 - 2 r2 t1) s2^2 + \left(-r2^2 t1 - 2 s1 (q1 - t2) r2 - 3 s1^2 \left(p1 - \frac{q2}{3}\right)\right) s2 + 2 q2 s1^2 r2 + t2 s1 r2^2}{r2 - s2},$$


$$\frac{-s2^3 t1 + ((-2 q1 + t2) s1 - 2 r2 t1) s2^2 - 3 s1 \left(\left(p1 - \frac{2 q2}{3}\right) s1 + \frac{r2 (q1 - 2 t2)}{3}\right) s2 + q2 s1^2 r2}{r2 - s2},$$


$$-\frac{s2 (s2^2 t1 + s1 (q1 - t2) s2 + s1^2 (p1 - q2))}{r2 - s2}$$


$$\frac{r2^3 t1 + ((2 q1 - t2) s1 + 2 s2 t1) r2^2 + 3 s1 \left(\left(p1 - \frac{2 q2}{3}\right) s1 + \frac{s2 (q1 - 2 t2)}{3}\right) r2 - s1^2 s2 q2}{r2 - s2},$$


$$\frac{(s1 q1 + 2 s2 t1) r2^2 + (s1^2 (3 p1 - q2) + 2 s1 (q1 - t2) s2 + s2^2 t1) r2 - 2 s1^2 s2 q2 - s1 s2^2 t2}{r2 - s2},$$


$$\frac{p1 r2 s1^2 + s1 s2 r2 q1 - s1^2 s2 q2 + r2 s2^2 t1 - s1 s2^2 t2}{r2 - s2}$$


```

$NSF_1^{4,1}$

```

> solve([M[1,3],M[1,4],M[2,1],M[2,2]], {q1,t1,q2,t2,s1,r2,s2});
{q1=- $\frac{2 s1 p1}{s2}$ , q2=0, r2=0, s1=s1, s2=s2, t1= $\frac{s1 (s1 p1+s2 t2)}{s2^2}$ , t2=t2}, {q1=q1, q2=q2, r2=r2, s1=0, s2=s2, t1=0, t2=t2}, {q1=- $\frac{2 s1 p1}{r2}$ , q2=0, r2=r2, s1=s1, s2=0, t1= $\frac{s1 (s1 p1+r2 t2)}{r2^2}$ , t2=t2}, {q1=0, q2=2 p1, r2=r2, s1=s1, s2=s2, t1=- $\frac{p1 s1^2}{r2 s2}$ , t2=- $\frac{s1 p1 (r2+s2)}{r2 s2}$ }

```

```

> p11 := -t1*r2*s2/(s1^2):
q21 := 2*p11:
t21 := -s1*p11*(r2+s2)/(r2*s2);
zamproc(p11,0,t1,0,0,q21,t21,0, s1,s1,r2,s2):
    
$$t21 := \frac{t1 (r2 + s2)}{s1}$$

    
$$(r2 - s2) r2 t1, (r2 - s2) r2 t1, 0, 0$$

    
$$0, 0, -(r2 - s2) s2 t1, -(r2 - s2) s2 t1$$


```

```

> r21 := -p1*s1^2/(t1*s2):
solve(t2 = -s1*p1*(r21+s2)/(r21*s2), s2);

$$\frac{\left(t2 + \sqrt{4 t1 p1 + t2^2}\right) s1}{2 t1}, -\frac{\left(-t2 + \sqrt{4 t1 p1 + t2^2}\right) s1}{2 t1}$$


```

```

> s21 := (t2+sqrt(4*p1*t1+t2^2))*s1/(2*t1);
r21 := -rationalize(p1*s1^2/(t1*s21));
q21 := 2*p1:

```

```

zamproc(p1,0,t1,0,0,q21,t2,0, s1,s1,r21,s21, full=false):

$$s21 := \frac{(t2 + \sqrt{4 p1 t1 + t2^2}) s1}{2 t1}$$


$$r21 := -\frac{(-t2 + \sqrt{4 p1 t1 + t2^2}) s1}{2 t1}$$


$$\frac{\sqrt{4 p1 t1 + t2^2} s1^2 (-t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}, \frac{\sqrt{4 p1 t1 + t2^2} s1^2 (-t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}, 0, 0$$


$$0, 0, \frac{\sqrt{4 p1 t1 + t2^2} s1^2 (t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}, \frac{\sqrt{4 p1 t1 + t2^2} s1^2 (t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}$$


> s11 := (4*p1*t1+t2^2)^(-1/4)*abs(2*t1)^(1/2)/abs(t2+sqrt(4*p1*t1+t2^2))^(1/2):
s21 := (t2+sqrt(4*p1*t1+t2^2))*s11/(2*t1);
r21 := -rationalize(p1*s11^2/(t1*s21));
zamproc(p1,0,t1,0,0,q21,t2,0, s11,s11,r21,s21):

$$s21 := \frac{(t2 + \sqrt{4 t1 p1 + t2^2}) \sqrt{2} \sqrt{|t1|}}{2 (4 t1 p1 + t2^2)^{1/4} \sqrt{|t2 + \sqrt{4 t1 p1 + t2^2}|} t1}$$


$$r21 := \frac{\sqrt{|t1|} \sqrt{2} (\sqrt{4 t1 p1 + t2^2} t2 - 4 t1 p1 - t2^2)}{2 (4 t1 p1 + t2^2)^{3/4} t1 \sqrt{|t2 + \sqrt{4 t1 p1 + t2^2}|}}$$


$$\frac{(-t2 + \sqrt{4 t1 p1 + t2^2}) \left| \frac{t1}{t2 + \sqrt{4 t1 p1 + t2^2}} \right|}{t1}, \frac{(4 t1 p1 + t2^2 - \sqrt{4 t1 p1 + t2^2} t2) \left| \frac{t1}{t2 + \sqrt{4 t1 p1 + t2^2}} \right|}{t1 \sqrt{4 t1 p1 + t2^2}}, 0, 0$$


$$0, 0, \frac{(4 t1 p1 + t2^2 + \sqrt{4 t1 p1 + t2^2} t2) \left| \frac{t1}{t2 + \sqrt{4 t1 p1 + t2^2}} \right|}{t1 \sqrt{4 t1 p1 + t2^2}}, \frac{(4 t1 p1 + t2^2 + \sqrt{4 t1 p1 + t2^2} t2) \left| \frac{t1}{t2 + \sqrt{4 t1 p1 + t2^2}} \right|}{t1 \sqrt{4 t1 p1 + t2^2}}$$


> u = (-t2+sqrt(4*p1*t1+t2^2))/(t2+sqrt(4*p1*t1+t2^2));

$$u = \frac{-t2 + \sqrt{4 t1 p1 + t2^2}}{t2 + \sqrt{4 t1 p1 + t2^2}}$$


> s22 := (t2-sqrt(4*p1*t1+t2^2))*s1/(2*t1);
r22 := -rationalize(p1*s1^2/(t1*s22));
q21 := 2*p1;
zamproc(p1,0,t1,0,0,q21,t2,0, s1,s1,r22,s22, full=false):

$$s22 := \frac{(t2 - \sqrt{4 p1 t1 + t2^2}) s1}{2 t1}$$


$$r22 := \frac{(t2 + \sqrt{4 p1 t1 + t2^2}) s1}{2 t1}$$


$$\frac{\sqrt{4 p1 t1 + t2^2} s1^2 (t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}, \frac{\sqrt{4 p1 t1 + t2^2} s1^2 (t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}, 0, 0$$


$$0, 0, \frac{\sqrt{4 p1 t1 + t2^2} s1^2 (-t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}, \frac{\sqrt{4 p1 t1 + t2^2} s1^2 (-t2 + \sqrt{4 p1 t1 + t2^2})}{2 t1}$$


> s12 := (4*p1*t1+t2^2)^(-1/4)*abs(2*t1)^(1/2)/abs(t2-sqrt(4*p1*t1+t2^2))^(1/2):
s22 := (t2-sqrt(4*p1*t1+t2^2))*s12/(2*t1);
r22 := -rationalize(p1*s12^2/(t1*s22));
zamproc(p1,0,t1,0,0,q21,t2,0, s12,s12,r22,s22):

$$s22 := \frac{(t2 - \sqrt{4 t1 p1 + t2^2}) \sqrt{2} \sqrt{|t1|}}{2 (4 t1 p1 + t2^2)^{1/4} \sqrt{|t2 - \sqrt{4 t1 p1 + t2^2}|} t1}$$


$$r22 := \frac{\sqrt{|t1|} \sqrt{2} (4 t1 p1 + t2^2 + \sqrt{4 t1 p1 + t2^2} t2)}{2 (4 t1 p1 + t2^2)^{3/4} t1 \sqrt{|t2 - \sqrt{4 t1 p1 + t2^2}|}}$$


$$\frac{(t2 + \sqrt{4 t1 p1 + t2^2}) \left| \frac{t1}{-t2 + \sqrt{4 t1 p1 + t2^2}} \right|}{t1}, \frac{(4 t1 p1 + t2^2 + \sqrt{4 t1 p1 + t2^2} t2) \left| \frac{t1}{-t2 + \sqrt{4 t1 p1 + t2^2}} \right|}{t1 \sqrt{4 t1 p1 + t2^2}}, 0, 0$$


```

```


$$0, 0, \frac{(4 t l p l + t^2 - \sqrt{4 t l p l + t^2}) t_2}{t l \sqrt{4 t l p l + t^2}} \left| \begin{array}{l} t l \\ -t_2 + \sqrt{4 t l p l + t^2} \end{array} \right|, \frac{(4 t l p l + t^2 - \sqrt{4 t l p l + t^2}) t_2}{t l \sqrt{4 t l p l + t^2}} \left| \begin{array}{l} t l \\ -t_2 + \sqrt{4 t l p l + t^2} \end{array} \right|$$


> u = (t2+sqrt(4*p1*t1+t2^2))/(-t2+sqrt(4*p1*t1+t2^2));

$$u = \frac{t_2 + \sqrt{4 t l p l + t^2}}{-t_2 + \sqrt{4 t l p l + t^2}}$$


> {q1=-2*s1*p1/r2, q2=0, r2=r2, s1=s1, s2=0, t1=s1*(s1*p1+r2*t2)/r2^2, t2 = t2};

$$\left\{ q l = -\frac{2 s l p l}{r^2}, q 2 = 0, r 2 = r 2, s l = s l, s 2 = 0, t l = \frac{s l (s l p l + r 2 t 2)}{r^2}, t 2 = t 2 \right\}$$


> solve(t1 = s1*(s1*p1+r2*t2)/r2^2, r2);

$$\frac{(t_2 + \sqrt{4 t l p l + t^2}) s l}{2 t l}, -\frac{(-t_2 + \sqrt{4 t l p l + t^2}) s l}{2 t l}$$


> r21 := (t2+sqrt(4*p1*t1+t2^2))*s1/(2*t1):
q11 := rationalize(-2*s1*p1/r21);
zamproc(p1,q11,t1,0,0,0,t2,0, s1,s1,r21,0):

$$q 11 := t 2 - \sqrt{4 t l p l + t^2}$$


$$\frac{t_2 s l^2 (t_2 + \sqrt{4 t l p l + t^2})}{2 t l}, \frac{t_2 s l^2 (t_2 + \sqrt{4 t l p l + t^2})}{2 t l}, 0, 0$$


$$0, 0, p l s l^2, p l s l^2$$


> s11 := abs(p1)^(-1/2):
r21 := (t2+sqrt(4*p1*t1+t2^2))*s11/(2*t1):
q11 := rationalize(-2*s11*p1/r21);
zamproc(p1,q11,t1,0,0,0,t2,0, s11,s11,r21,0):

$$q 11 := t 2 - \sqrt{4 t l p l + t^2}$$


$$\frac{t_2 (t_2 + \sqrt{4 t l p l + t^2})}{2 |p l| t l}, \frac{t_2 (t_2 + \sqrt{4 t l p l + t^2})}{2 |p l| t l}, 0, 0$$


$$0, 0, \frac{p l}{|p l|}, \frac{p l}{|p l|}$$


> u = t2*(t2+sqrt(4*p1*t1+t2^2))/(2*p1*t1);

$$u = \frac{t_2 (t_2 + \sqrt{4 t l p l + t^2})}{2 t l p l}$$


> r22 := (t2-sqrt(4*p1*t1+t2^2))*s1/(2*t1):
q12 := rationalize(-2*s1*p1/r22);
zamproc(p1,q12,t1,0,0,0,t2,0, s1,s1,r22,0):

$$q 12 := t 2 + \sqrt{4 p l t l + t^2}$$


$$-\frac{s l^2 t_2 (-t_2 + \sqrt{4 p l t l + t^2})}{2 t l}, -\frac{s l^2 t_2 (-t_2 + \sqrt{4 p l t l + t^2})}{2 t l}, 0, 0$$


$$0, 0, p l s l^2, p l s l^2$$


> s12 := abs(p1)^(-1/2):
r22 := (t2-sqrt(4*p1*t1+t2^2))*s12/(2*t1):
q12 := rationalize(-2*s12*p1/r22);
zamproc(p1,q12,t1,0,0,0,t2,0, s12,s12,r22,0):

$$q 12 := t 2 + \sqrt{4 p l t l + t^2}$$


$$-\frac{t_2 (-t_2 + \sqrt{4 p l t l + t^2})}{2 |p l| t l}, -\frac{t_2 (-t_2 + \sqrt{4 p l t l + t^2})}{2 |p l| t l}, 0, 0$$


$$0, 0, \frac{p l}{|p l|}, \frac{p l}{|p l|}$$


> u = t2*(t2-sqrt(4*p1*t1+t2^2))/(2*p1*t1);

$$u = \frac{t_2 (-t_2 - \sqrt{4 p l t l + t^2})}{2 p l t l}$$


NSF34,1

> solve([M[1,2],M[1,4],M[2,1],M[2,2]], {p1,q2,r2,s2});

$$\left\{ p l = \frac{(2 q l - 3 t 2) q l}{9 t l}, q 2 = 0, r 2 = 0, s 2 = -\frac{s l (2 q l - 3 t 2)}{3 t l} \right\}, \left\{ p l = \frac{(2 q l - 3 t 2) (2 q l + t 2)}{16 t l}, q 2 = \frac{(2 q l - 3 t 2) t 2}{8 t l}, r 2 = -\frac{s l (2 q l - 3 t 2)}{4 t l}, s 2 = 0 \right\},$$


```

```


$$\left\{ p1 = \frac{q1(q1-t2)}{t1}, q2 = \frac{q1(3q1-2t2)}{t1}, r2 = \frac{q1s1}{t1}, s2 = -\frac{(2q1-t2)s1}{t1} \right\}$$


> p11 := q1*(q1-t2)/t1:
q21 := q1*(3*q1-2*t2)/t1:
r21 := q1*s1/t1:
s21 := -(2*q1-t2)*s1/t1:
zamproc(p11,q1,t1,0,0,q21,t2,0, s1,s1,r21,s21, full=false):

$$\frac{s1^2 q1 (3 q1 - t2)}{t1}, 0, -\frac{s1^2 q1 (3 q1 - t2)}{t1}, 0$$


$$0, 0, \frac{s1^2 (3 q1 - t2) (q1 - t2)}{t1}, \frac{s1^2 (3 q1 - t2) (q1 - t2)}{t1}$$


> s11 := abs(t1)^(1/2)/(abs(3*q1-t2)*abs(q1-t2))^(1/2):
r21 := q1*s11/t1:
s21 := -(2*q1-t2)*s11/t1:
zamproc(p11,q1,t1,0,0,q21,t2,0, s11,s11,r21,s21):

$$\frac{q1 (3 q1 - t2) \left| \frac{t1}{(q1 - t2) (3 q1 - t2)} \right|}{t1}, 0, -\frac{q1 (3 q1 - t2) \left| \frac{t1}{(q1 - t2) (3 q1 - t2)} \right|}{t1}, 0$$


$$0, 0, \frac{\left| \frac{t1}{(q1 - t2) (3 q1 - t2)} \right| (q1 - t2) (3 q1 - t2)}{t1}, \frac{\left| \frac{t1}{(q1 - t2) (3 q1 - t2)} \right| (q1 - t2) (3 q1 - t2)}{t1}$$


> u = q1/(q1-t2);

$$u = \frac{q1}{q1 - t2}$$


> {p1=(2*q1-3*t2)*q1/(9*t1), q2=0, r2=0, s2=-s1*(2*q1-3*t2)/(3*t1)};

$$\left\{ p1 = \frac{(2 q1 - 3 t2) q1}{9 t1}, q2 = 0, r2 = 0, s2 = -\frac{s1 (2 q1 - 3 t2)}{3 t1} \right\}$$


> p11 := (2*q1-3*t2)*q1/(9*t1):
s21 := -s1*(2*q1-3*t2)/(3*t1):
zamproc(p11,q1,t1,0,0,0,t2,0, s1,s1,0,s21, full=false):

$$\frac{s1^2 (2 q1 - 3 t2) q1}{9 t1}, 0, -\frac{s1^2 (2 q1 - 3 t2) q1}{9 t1}, 0$$


$$0, 0, -\frac{t2 s1^2 (2 q1 - 3 t2)}{3 t1}, -\frac{t2 s1^2 (2 q1 - 3 t2)}{3 t1}$$


> s11 := sqrt(3)*abs(t1)^(1/2)/(abs(t2)*abs(2*q1-3*t2))^(1/2):
s21 := -s11*(2*q1-3*t2)/(3*t1):
zamproc(p11,q1,t1,0,0,0,t2,0, s11,s11,0,s21):

$$\frac{q1 (2 q1 - 3 t2) \left| \frac{t1}{t2 (2 q1 - 3 t2)} \right|}{3 t1}, 0, -\frac{q1 (2 q1 - 3 t2) \left| \frac{t1}{t2 (2 q1 - 3 t2)} \right|}{3 t1}, 0$$


$$0, 0, -\frac{t2 (2 q1 - 3 t2) \left| \frac{t1}{t2 (2 q1 - 3 t2)} \right|}{t1}, -\frac{t2 (2 q1 - 3 t2) \left| \frac{t1}{t2 (2 q1 - 3 t2)} \right|}{t1}$$


> u = -q1/(3*t2);

$$u = -\frac{q1}{3 t2}$$


> {p1=(2*q1-3*t2)*(2*q1+t2)/(16*t1), q2=(2*q1-3*t2)*t2/(8*t1), r2=-s1*(2*q1-3*t2)/(4*t1), s2=0};

$$\left\{ p1 = \frac{(2 q1 - 3 t2) (2 q1 + t2)}{16 t1}, q2 = \frac{(2 q1 - 3 t2) t2}{8 t1}, r2 = -\frac{s1 (2 q1 - 3 t2)}{4 t1}, s2 = 0 \right\}$$


> p11 := (2*q1-3*t2)*(2*q1+t2)/(16*t1):
q21 := (2*q1-3*t2)*t2/(8*t1):
r21 := -s1*(2*q1-3*t2)/(4*t1):
zamproc(p11,q1,t1,0,0,q21,t2,0, s1,s1,r21,0, full=false):

$$-\frac{t2 s1^2 (2 q1 - 3 t2)}{8 t1}, 0, \frac{t2 s1^2 (2 q1 - 3 t2)}{8 t1}, 0$$


$$0, 0, \frac{(2 q1 - 3 t2) (2 q1 + t2) s1^2}{16 t1}, \frac{(2 q1 - 3 t2) (2 q1 + t2) s1^2}{16 t1}$$


> s11 := 4*abs(t1)^(1/2)/(abs(2*q1-3*t2)*abs(2*q1+t2))^(1/2):
r21 := -s11*(2*q1-3*t2)/(4*t1):
zamproc(p11,q1,t1,0,0,q21,t2,0, s11,s11,r21,0):

$$-\frac{2 t2 (2 q1 - 3 t2) \left| \frac{t1}{(2 q1 - 3 t2) (2 q1 + t2)} \right|}{t1}, 0, \frac{2 t2 (2 q1 - 3 t2) \left| \frac{t1}{(2 q1 - 3 t2) (2 q1 + t2)} \right|}{t1}, 0$$


```

$$0, 0, \frac{(2 q l - 3 t l) (2 q l + t l)}{t l} \left| \frac{t l}{(2 q l - 3 t l) (2 q l + t l)} \right|, \frac{(2 q l - 3 t l) (2 q l + t l)}{t l} \left| \frac{t l}{(2 q l - 3 t l) (2 q l + t l)} \right|$$

$$> u = -2 * t l / (2 * q l + t l);$$

$$u = -\frac{2 t l}{2 q l + t l}$$

$$NSF_{13}^{4,1}$$

$$> solve([M[1,2], M[1,3], M[2,1], M[2,3]], \{p1, q2, r2, s2\});$$

$$\left\{ p1 = \frac{(2 q l - t l) (2 q l + t l)}{12 t l}, q2 = \frac{(2 q l - t l) t l}{4 t l}, r2 = 0, s2 = -\frac{(2 q l - t l) s l}{2 t l} \right\}, \left\{ p1 = (4 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) q l^3 - 4 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) q l^2 t l^2 - 7 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) q l t l^2 + 4 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) t l^3 + 8 q l^3 t l^2 - 8 q l^2 t l^2 + 4 q l t l^3 - t l^4) \sqrt{2} (8 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) q l - 8 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) t l + 16 q l t l - 7 t l^2) t l), q2 = \frac{1}{2 t l (4 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) - t l)} (2 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) q l^2 + 7 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) q l t l^2 - 4 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) t l^2 + 4 q l^2 t l^2 - 4 q l t l^2 + t l^3), r2 = -\frac{s l (4 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) q l - 2 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) t l + 2 q l t l - t l^2)}{t l (4 RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) - t l)}, s2 = RootOf(2 Z^2 - q l Z - 2 q l t l + t l^2) s l \right\}$$

$$> solve([M[1,2], M[1,3], M[2,1], M[2,3]], \{p1, q1, t1, r2, s1, s2\});$$

$$\left\{ p1 = \frac{q2 (2 q l + t l)}{3 t l}, q1 = q l, r2 = 0, s1 = s l, s2 = -\frac{2 s l q2}{t l}, t l = \frac{(2 q l - t l) t l}{4 q2} \right\}, \left\{ p1 = p1, q1 = q l, r2 = r2, s1 = 0, s2 = s2, t l = 0 \right\}, \left\{ p1 = \frac{(r2^3 + 2 r2^2 s2 + 2 r2 s2^2 + s2^3) q2}{(2 r2 + s2) s2^2}, q1 = \frac{t l (3 r2^2 + 4 r2 s2 + 2 s2^2)}{s2 (r2 + 2 s2)}, r2 = r2, s1 = -\frac{s2 t l (2 r2 + s2)}{q2 (r2 + 2 s2)}, s2 = s2, t l = \frac{t l^2 (2 r2 + s2)^2}{q2 (r2 + 2 s2)^2} \right\}$$

$$> solve([M[1,2], M[1,3], M[2,1], M[2,3]], \{p1, q1, t1, t2, r2, s1, s2\});$$

$$\left\{ p1 = -\frac{s2 q l - s1 q2}{3 s l}, q1 = q l, r2 = 0, s1 = s l, s2 = s2, t l = -\frac{s1 (s2 q l + s1 q2)}{s2^2}, t2 = -\frac{2 s l q2}{s2} \right\}, \left\{ p1 = p1, q1 = q l, r2 = r2, s1 = 0, s2 = s2, t l = 0, t2 = t2 \right\}, \left\{ p1 = \frac{(r2^3 + 2 r2^2 s2 + 2 r2 s2^2 + s2^3) q2}{(2 r2 + s2) s2^2}, q1 = \frac{t l (3 r2^2 + 4 r2 s2 + 2 s2^2)}{s2 (r2 + 2 s2)}, r2 = r2, s1 = -\frac{s2 t l (2 r2 + s2)}{q2 (r2 + 2 s2)}, s2 = s2, t l = \frac{t l^2 (2 r2 + s2)^2}{q2 (r2 + 2 s2)^2}, t2 = t2 \right\}, \left\{ p1 = q2, q1 = \frac{2 s l q2}{s2}, r2 = -2 s2, s1 = s l, s2 = s2, t l = \frac{s l^2 q2}{s2^2}, t2 = 0 \right\}$$

$$> \{p1=(2*q1-t2)*(2*q1+t2)/(12*t1), q2=(2*q1-t2)*t2/(4*t1), r2=0, s2=- (2*q1-t2)*s1/(2*t1)\};$$

$$\left\{ p1 = \frac{(2 q l - t l) (2 q l + t l)}{12 t l}, q2 = \frac{(2 q l - t l) t l}{4 t l}, r2 = 0, s2 = -\frac{(2 q l - t l) s l}{2 t l} \right\}$$

$$> p11 := (2*q1-t2)*(2*q1+t2)/(12*t1);$$

$$q21 := (2*q1-t2)*t2/(4*t1);$$

$$s21 := -(2*q1-t2)*s1/(2*t1);$$

$$zamproc(p11, q1, t1, 0, 0, q21, t2, 0, s1, s1, 0, s21):$$

$$\frac{s l^2 (4 q l^2 - t l^2)}{12 t l}, 0, 0, \frac{s l^2 (4 q l^2 - t l^2)}{12 t l}$$

$$0, \frac{(2 q l - t l) t l s l^2}{4 t l}, 0, -\frac{(2 q l - t l) t l s l^2}{4 t l}$$

$$> s11 := 2*abs(t1)^(1/2) / (abs(2*q1-t2)^(1/2)*abs(t2)^(1/2));$$

$$s21 := -(2*q1-t2)*s11/(2*t1);$$

$$zamproc(p11, q1, t1, 0, 0, q21, t2, 0, s11, s11, 0, s21):$$

$$\frac{\left| \frac{t l}{t l (2 q l - t l)} \right| (4 q l^2 - t l^2)}{3 t l}, 0, 0, \frac{\left| \frac{t l}{t l (2 q l - t l)} \right| (4 q l^2 - t l^2)}{3 t l}$$

$$0, \frac{t l (2 q l - t l) \left| \frac{t l}{t l (2 q l - t l)} \right|}{t l}, 0, -\frac{t l (2 q l - t l) \left| \frac{t l}{t l (2 q l - t l)} \right|}{t l}$$

$$> u = (2*q1+t2)/(3*t2);$$

$$u = \frac{2 q l + t l}{3 t l}$$

$$> \{p1=(r2^3+2 r2^2 s2+2 r2 s2^2+s2^3) q2/((2 r2+s2)*s2^2), q1=t2*(3*r2^2+4*r2*s2+2*s2^2)/(s2*(r2+2*s2)), r2=r2, s1=-s2*t2*(2*r2+s2)/(q2*(r2+2*s2)), s2=s2, t1=t2^2*(2*r2+s2)^2/(q2*(r2+2*s2)^2)\};$$

$$\left\{ p1 = \frac{(r2^3 + 2 r2^2 s2 + 2 r2 s2^2 + s2^3) q2}{(2 r2 + s2) s2^2}, q1 = \frac{t l (3 r2^2 + 4 r2 s2 + 2 s2^2)}{s2 (r2 + 2 s2)}, r2 = r2, s1 = -\frac{s2 t l (2 r2 + s2)}{q2 (r2 + 2 s2)}, s2 = s2, t l = \frac{t l^2 (2 r2 + s2)^2}{q2 (r2 + 2 s2)^2} \right\}$$

```

> evala([solve(t1 = t2^2*(2*r2+s2)^2/(q2*(r2+2*s2)^2), r2)]);

$$\left[ -\frac{(t2+2\sqrt{q2 t1}) s2}{2 t2+\sqrt{q2 t1}}, -\frac{(t2-2\sqrt{q2 t1}) s2}{-\sqrt{q2 t1}+2 t2} \right]$$

> r21 := -(t2+2*sqrt(q2*t1))*s2/(2*t2+sqrt(q2*t1));
s11 := simplify(-s2*t2*(2*r21+s2)/(q2*(r21+2*s2)));
p11 := simplify((r21^3+2*r21^2*s2+2*r21*s2^2+s2^3)*q2/((2*r21+s2)*s2^2));
q11 := simplify(t2*(3*r21^2+4*r21*s2+2*s2^2)/(s2*(r21+2*s2)));
zamproc(p11,q11,t1,0,0,q2,t2,0, s11,s11,r21,s2, full=false):

$$s11 := \frac{\sqrt{q2 t1} s2}{q2}$$


$$p11 := \frac{q2 (q2 t1 \sqrt{q2 t1} - t2^3)}{\sqrt{q2 t1} (2 t2 + \sqrt{q2 t1})^2}$$


$$q11 := \frac{2 q2 t1 + t2^2}{2 t2 + \sqrt{q2 t1}}$$


$$\frac{(q2 t1 - t2^2) s2^2 t1}{(2 t2 + \sqrt{q2 t1}) \sqrt{q2 t1}}, 0, 0, \frac{(q2 t1 - t2^2) s2^2 t1}{(2 t2 + \sqrt{q2 t1}) \sqrt{q2 t1}}$$


$$0, -\frac{3 s2^2 t1 (q2^2 t1^2 + 4 q2 t1 t2^2 + 3 q2 t1 t2 \sqrt{q2 t1} + t2^4 + 3 t2^3 \sqrt{q2 t1})}{(2 t2 + \sqrt{q2 t1})^2 \sqrt{q2 t1}} (t2 + \sqrt{q2 t1}), 0, \frac{3 s2^2 t1 (q2^2 t1^2 + 4 q2 t1 t2^2 + 3 q2 t1 t2 \sqrt{q2 t1} + t2^4 + 3 t2^3 \sqrt{q2 t1})}{(2 t2 + \sqrt{q2 t1})^2 \sqrt{q2 t1}} (t2 + \sqrt{q2 t1})$$

> factor(q2^2*t1^2+4*q2*t1*t2^2+3*q2*t1*t2*sqrt(q2*t1)+t2^4+3*t2^3*sqrt(q2*t1), sqrt(q2*t1));

$$(q2 t1 + t2 \sqrt{q2 t1} + t2^2) (t2 + \sqrt{q2 t1})^2$$

> s21 := (2*t2+sqrt(q2*t1))*(q2*t1)^(1/4)/(sqrt(3)*(q2*t1+t2*sqrt(q2*t1)+t2^2)^(1/2)*abs(t2+sqrt(q2*t1))^(1/2)*abs(t1)^(1/2));
r21 := -(t2+2*sqrt(q2*t1))*s21/(2*t2+sqrt(q2*t1));
s11 := simplify(-s21*t2*(2*r21+s21)/(q2*(r21+2*s21)));
p11 := simplify((r21^3+2*r21^2*s21+2*r21*s21^2+s21^3)*q2/((2*r21+s21)*s21^2));
q11 := simplify(t2*(3*r21^2+4*r21*s21+2*s21^2)/(s21*(r21+2*s21)));
zamproc(p11,q11,t1,0,0,q2,t2,0, s11,s11,r21,s21):

$$s11 := \frac{(2 t2 + \sqrt{q2 t1}) (q2 t1)^{3/4} \sqrt{3}}{3 \sqrt{q2 t1 + t2 \sqrt{q2 t1} + t2^2} \sqrt{|t2 + \sqrt{q2 t1}|} \sqrt{|t1|} q2}$$


$$p11 := \frac{\sqrt{q2 t1} (q2 t1 \sqrt{q2 t1} - t2^3) |t1| (t2 + \sqrt{q2 t1})}{|t2 + \sqrt{q2 t1}| |t1| (2 t2 + \sqrt{q2 t1})^2}$$


$$q11 := \frac{1}{|t1| (t2 + \sqrt{q2 t1})} \frac{(2 q2 t1 + t2^2) |t2 + \sqrt{q2 t1}| |t1|}{2 t2 + \sqrt{q2 t1}}$$


$$\frac{\sqrt{q2 t1} (2 t2 + \sqrt{q2 t1}) (q2 t1 + t2 \sqrt{q2 t1}) (q2 t1 - t2^2) \left| \frac{1}{t1 (t2 + \sqrt{q2 t1})} \right|}{3 q2 (t2 + \sqrt{q2 t1}) (q2 t1 + t2 \sqrt{q2 t1} + t2^2)}, 0, 0,$$


$$\frac{\sqrt{q2 t1} (2 t2 + \sqrt{q2 t1}) (q2 t1 + t2 \sqrt{q2 t1}) (q2 t1 - t2^2) \left| \frac{1}{t1 (t2 + \sqrt{q2 t1})} \right|}{3 q2 (t2 + \sqrt{q2 t1}) (q2 t1 + t2 \sqrt{q2 t1} + t2^2)}$$


$$0, -\frac{t1 (q2^2 t1^2 + 4 q2 t1 t2^2 + 3 q2 t1 t2 \sqrt{q2 t1} + t2^4 + 3 t2^3 \sqrt{q2 t1}) \left| \frac{1}{t1 (t2 + \sqrt{q2 t1})} \right|}{(t2 + \sqrt{q2 t1}) (q2 t1 + t2 \sqrt{q2 t1} + t2^2)},$$


$$\frac{\sqrt{q2 t1} (3 q2^2 t1^2 t2 + \sqrt{q2 t1} q2^2 t1^2 + 3 q2 t1 t2^3 + 4 q2 t1 t2^2 \sqrt{q2 t1} + t2^4 \sqrt{q2 t1}) \left| \frac{1}{t1 (t2 + \sqrt{q2 t1})} \right|}{q2 (t2 + \sqrt{q2 t1}) (q2 t1 + t2 \sqrt{q2 t1} + t2^2)}$$

> u = -(2*t2+sqrt(q2*t1))*(t2+sqrt(q2*t1))*(-t2+sqrt(q2*t1))/(3*(q2*t1+t2*sqrt(q2*t1)+t2^2)*(t2+sqrt(q2*t1)));

$$u = -\frac{(2 t2 + \sqrt{q2 t1}) (-t2 + \sqrt{q2 t1})}{3 (q2 t1 + t2 \sqrt{q2 t1} + t2^2)}$$

> {p1=q2, q1=2*s1*q2/s2, r2=-2*s2, s1=s1, s2=s2, t1=s1^2*q2/s2^2, t2=0};

$$\left\{ p1 = q2, q1 = \frac{2 s1 q2}{s2}, r2 = -2 s2, s1 = s1, s2 = s2, t1 = \frac{s1^2 q2}{s2^2}, t2 = 0 \right\}$$


```

```

> p11 := q2:
q11 := 2*s1*q2/s2:
t11 := s1^2*q2/s2^2:
r21 := -2*s2:
zamproc(p11,q11,t11,0,0,q2,0,0, s1,s1,r21,s2, full=false):
           $s1^2 q2, 0, 0, s1^2 q2$ 
           $0, -3 s1^2 q2, 0, 3 s1^2 q2$ 

```

Результат замены с $r_1 = s_1$ в исходной системе с $p_2 \neq 0$:

$$\begin{aligned}
&> M := \text{zamproc}(p1, q1, t1, 0, p2, q2, t2, 0, s1, s1, r2, s2): \\
&\quad \frac{-p1 s1^2 s2 + p2 s1^3 - q1 r2 s1 s2 + q2 r2 s1^2 + r2^2 s1 t2 - r2^2 s2 t1}{r2 - s2}, \\
&\quad \frac{3 p2 s1^3 + ((-3 p1 + q2) s2 + 2 q2 r2) s1^2 + (-q1 s2^2 - 2 r2 (q1 - t2) s2 + t2 r2^2) s1 - r2 s2 t1 (r2 + 2 s2)}{r2 - s2}, \\
&\quad \frac{-s2^3 t1 + ((-2 q1 + t2) s1 - 2 r2 t1) s2^2 - 3 s1 \left(\left(p1 - \frac{2 q2}{3} \right) s1 + \frac{r2 (q1 - 2 t2)}{3} \right) s2 + 3 p2 s1^3 + q2 r2 s1^2}{r2 - s2}, \\
&\quad \frac{-s2^3 t1 - s1 (q1 - t2) s2^2 - s1^2 (p1 - q2) s2 + p2 s1^3}{r2 - s2}, \\
&\quad \frac{r2^3 t1 + s1 (q1 - t2) r2^2 + s1^2 (p1 - q2) r2 - p2 s1^3}{r2 - s2}, \\
&\quad \frac{r2^3 t1 + ((2 q1 - t2) s1 + 2 s2 t1) r2^2 + 3 s1 \left(\left(p1 - \frac{2 q2}{3} \right) s1 + \frac{s2 (q1 - 2 t2)}{3} \right) r2 - 3 p2 s1^3 - q2 s1^2 s2}{r2 - s2}, \\
&\quad \frac{(s1 q1 + 2 s2 t1) r2^2 + ((3 p1 - q2) s1^2 + 2 s2 (q1 - t2) s1 + s2^2 t1) r2 - 3 p2 s1^3 - 2 q2 s1^2 s2 - s1 s2^2 t2}{r2 - s2}, \\
&\quad \frac{(r2 t1 - s1 t2) s2^2 + (q1 r2 s1 - s1^2 q2) s2 + p1 r2 s1^2 - p2 s1^3}{r2 - s2}
\end{aligned}$$

$NSF_{28}^{4,1}$

```

> evala([solve([M[1,1],M[1,3],M[2,2],M[2,3]], {p2,q2,r2,s2})]);
[[p2=  $\frac{1}{t1^2 (q1+2 t2)^3} (27 p1^3 t1^3 - 21 p1^2 q1^2 t1^2 + 6 p1^2 q1 t1^2 t2 + 15 p1^2 t1^2 t2^2 + 4 p1 q1^4 t1 - 12 p1 q1^3 t1 t2 - 27 p1 q1^2 t1 t2^2 - 16 p1 q1 t1 t2^3$ 
 $- 3 p1 t1 t2^4 + 4 q1^5 t2 + 12 q1^3 t2^3 + 14 q1^2 t2^4 + 6 q1 t2^5 + t2^6), q2=$ 
 $- \frac{9 p1^2 t1^2 - 3 p1 q1^2 t1 + 6 p1 q1 t1 t2 + 6 p1 t1 t2^2 - 4 q1^3 t2 - 10 q1^2 t2^2 - 10 q1 t2^3 - 3 t2^4}{t1 (q1+2 t2)^2}, r2= - \frac{s1 (3 p1 t1 + 2 q1 t2 + t2^2)}{t1 (q1+2 t2)}, s2$ 
 $= \frac{(6 p1 t1 - 2 q1^2 - q1 t2) s1}{t1 (q1+2 t2)} \Bigg]]$ 
```

$$\begin{aligned}
&> \text{collect}(27*p1^3*t1^3-21*p1^2*q1^2*t1^2+6*p1^2*q1*t1^2*t2+15*p1^2*t1^2*t2^2+4*p1*q1^4*t1-12*p1*q1^3*t1*t2-27*p1*q1^2*t1*t2^2-16*p1*q1*t1*t2^3-3*p1*t1*t2^4+4*q1^5*t2+12*q1^4*t2^2+17*q1^3*t2^3+14*q1^2*t2^4+6*q1*t2^5+t2^6), q2= \\
&\quad 27 p1^3 t1^3 - 3 (7 q1 + 5 t2) (q1 - t2) t1^2 p1^2 + (q1^2 - 4 q1 t2 - 3 t2^2) (2 q1 + t2)^2 t1 p1 + t2 (q1 + t2) (q1^2 + q1 t2 + t2^2) (2 q1 + t2)^2 \\
&> \text{subs}(q1 = -t2, 27*z^3 - (3*(7*q1+5*t2))*(q1-t2)*z^2 + (q1^2-4*q1*t2-3*t2^2)*(2*q1+t2)^2*z+t2*(q1+t2)*(q1^2+q1*t2+t2^2)*(2*q1+t2)^2); \\
&\quad 2 t2^4 z - 12 t2^2 z^2 + 27 z^3 \\
&> \text{collect}(9*p1^2*t1^2-3*p1*q1^2*t1+6*p1*q1*t1*t2+6*p1*t1*t2^2-4*q1^3*t2-10*q1^2*t2^2-10*q1*t2^3-3*t2^4, [p1,t1], factor);
&\quad 9 p1^2 t1^2 + (-3 q1^2 + 6 q1 t2 + 6 t2^2) t1 p1 - t2 (2 q1 + t2) (2 q1^2 + 4 q1 t2 + 3 t2^2) \\
&> p11 := theta/t1:
p21 := (27*theta^3 - (3*(7*q1+5*t2))*(q1-t2)*theta^2 + (q1^2-4*q1*t2-3*t2^2)*(2*q1+t2)^2*theta+t2*(q1+t2)*(q1^2+q1*t2+t2^2)*(2*q1+t2)^2)/(t1^2*(q1+2*t2)^3):
q21 := -(9*theta^2 + (-3*q1^2+6*q1*t2+6*t2^2)*theta - t2*(2*q1+t2)*(2*q1^2+4*q1*t2+3*t2^2))/(t1*(q1+2*t2)^2):
r21 := -s1*(3*theta+2*q1*t2+t2^2)/(t1*(q1+2*t2)):
s21 := (6*theta-2*q1^2-q1*t2)*s1/(t1*(q1+2*t2)):
zamproc(p11,q1,t1,0,p21,q21,t2,0, s1,s1,r21,s21, full=false):
pml(p11,q1,t1,0,p21,q21,t2,0, s1,s1,r21,s21);
&\quad 0, - \frac{s1^2 (2 q1^2 - q1 t2 - t2^2 - 9 \theta) (q1^2 + q1 t2 + t2^2 - 3 \theta)}{t1 (q1+2 t2)^2}, 0, \frac{s1^2 (2 q1^2 - q1 t2 - t2^2 - 9 \theta) (q1^2 + q1 t2 + t2^2 - 3 \theta)}{t1 (q1+2 t2)^2} \\
&\quad - \frac{s1^2 (2 q1^2 - q1 t2 - t2^2 - 9 \theta) (q1 t2 + t2^2 + \theta)}{t1 (q1+2 t2)^2}, 0, 0, - \frac{s1^2 (2 q1^2 - q1 t2 - t2^2 - 9 \theta) (q1 t2 + t2^2 + \theta)}{t1 (q1+2 t2)^2}
\end{aligned}$$

Resultant of G: $\frac{(q1 t2 + t2^2 + \theta)^2 (q1^2 + q1 t2 + t2^2 - 3 \theta)^2 (2 q1^2 - q1 t2 - t2^2 - 9 \theta)^2}{t1^2 (q1 + 2 t2)^6}$

```

> s11 := abs(t1)^(1/2)*(q1+2*t2)/(abs(q1*t2+t2^2+theta)^(1/2)*abs(9*theta-2*q1^2+q1*t2+t2^2)^(1/2));
r21 := -s11*(3*theta+2*q1*t2+t2^2)/(t1*(q1+2*t2));
s21 := (6*theta-2*q1^2-q1*t2)*s11/(t1*(q1+2*t2));
zamproc(p11,q1,t1,0,p21,q21,t2,0, s1,s11,r21,s21, full=false):
0, -  $\frac{(2 q1^2 - q1 t2 - t2^2 - 9 \theta) \left| \frac{t1}{(q1 t2 + t2^2 + \theta) (2 q1^2 - q1 t2 - t2^2 - 9 \theta)} \right| (q1^2 + q1 t2 + t2^2 - 3 \theta)}{t1}, 0,$ 
 $\frac{(2 q1^2 - q1 t2 - t2^2 - 9 \theta) \left| \frac{t1}{(q1 t2 + t2^2 + \theta) (2 q1^2 - q1 t2 - t2^2 - 9 \theta)} \right| (q1^2 + q1 t2 + t2^2 - 3 \theta)}{t1}$ 
 $\frac{(q1 t2 + t2^2 + \theta) (2 q1^2 - q1 t2 - t2^2 - 9 \theta) \left| \frac{t1}{(q1 t2 + t2^2 + \theta) (2 q1^2 - q1 t2 - t2^2 - 9 \theta)} \right|}{t1}, 0, 0,$ 
 $\frac{(q1 t2 + t2^2 + \theta) (2 q1^2 - q1 t2 - t2^2 - 9 \theta) \left| \frac{t1}{(q1 t2 + t2^2 + \theta) (2 q1^2 - q1 t2 - t2^2 - 9 \theta)} \right|}{t1}$ 

```

$\geq u = (3*theta-q1^2-q1*t2-t2^2) / (q1*t2+t2^2+theta);$
 $u = \frac{-q1^2 - q1 t2 - t2^2 + 3 \theta}{q1 t2 + t2^2 + \theta}$

```

> q11 := -2*t2;
N := zamproc(p1,q11,t1,0,p2,q2,t2,0, s1,s1,r2,s2):
p2 s1^3 + (-s2 p1 + q2 r2) s1^2 + r2 t2 (r2 + 2 s2) s1 - r2^2 s2 t1,
 $\frac{r2 - s2}{r2 s2}$ 
 $\frac{3 p2 s1^3 + ((-3 p1 + q2) s2 + 2 q2 r2) s1^2 + t2 (r2^2 + 6 r2 s2 + 2 s2^2) s1 - r2 s2 t1 (r2 + 2 s2)}{r2 - s2},$ 
 $\frac{-s2^3 t1 + (-2 r2 t1 + 5 s1 t2) s2^2 + ((-3 p1 + 2 q2) s1^2 + 4 r2 t2 s1) s2 + 3 p2 s1^3 + q2 r2 s1^2}{r2 - s2}, \frac{-s2^3 t1 + 3 s1 s2^2 t2 - s1^2 (p1 - q2) s2 + p2 s1^3}{r2 - s2}$ 
 $\frac{r2^3 t1 - 3 r2^2 s1 t2 + s1^2 (p1 - q2) r2 - p2 s1^3}{r2 - s2}, \frac{r2^3 t1 + (-5 s1 t2 + 2 s2 t1) r2^2 + ((3 p1 - 2 q2) s1^2 - 4 s1 s2 t2) r2 - 3 p2 s1^3 - q2 s1^2 s2}{r2 - s2},$ 
 $\frac{(-2 s1 t2 + 2 s2 t1) r2^2 + ((3 p1 - q2) s1^2 - 6 s1 s2 t2 + s2^2 t1) r2 - 3 p2 s1^3 - 2 q2 s1^2 s2 - s1 s2^2 t2}{r2 - s2},$ 
 $\frac{-p2 s1^3 + (p1 r2 - s2 q2) s1^2 - 2 s2 \left( r2 + \frac{s2}{2} \right) t2 s1 + r2 s2^2 t1}{r2 - s2}$ 

```

$\geq \text{evala}([\text{solve}([\text{N}[1,1],\text{N}[1,3],\text{N}[2,2],\text{N}[2,3]], \{p1,p2,q2,s2\})])$;
 $\left\{ p1 = \frac{t2^2}{t1}, p2 = -\frac{r2^3 t1^3 - 4 r2^2 s1 t2 t1^2 + 5 r2 s1^2 t1 t2^2 - 3 s1^3 t2^3}{t1^2 s1^3}, q2 = -\frac{t1^2 r2^2 - 2 r2 t2 s1 t1 + 3 s1^2 t2^2}{t1 s1^2}, s2 = -\frac{2 r2 t1 - 3 s1 t2}{t1} \right\}$

$\geq \text{solve}(z^{3-4*z^2+5*z-3}, z);$
 $\frac{(116 + 12 \sqrt{93})^{1/3}}{6} + \frac{2}{3 (116 + 12 \sqrt{93})^{1/3}} + \frac{4}{3}, -\frac{(116 + 12 \sqrt{93})^{1/3}}{12} - \frac{1}{3 (116 + 12 \sqrt{93})^{1/3}} + \frac{4}{3}$
 $+ \frac{1 \sqrt{3} \left(\frac{(116 + 12 \sqrt{93})^{1/3}}{6} - \frac{2}{3 (116 + 12 \sqrt{93})^{1/3}} \right)}{2}, -\frac{(116 + 12 \sqrt{93})^{1/3}}{12} - \frac{1}{3 (116 + 12 \sqrt{93})^{1/3}} + \frac{4}{3}$
 $- \frac{1 \sqrt{3} \left(\frac{(116 + 12 \sqrt{93})^{1/3}}{6} - \frac{2}{3 (116 + 12 \sqrt{93})^{1/3}} \right)}{2}$

$\geq p11 := t2^2/t1;$
 $p21 := -(r2^3*t1^3-4*r2^2*s1*t1^2+5*r2*s1^2*t1*t2^2-3*s1^3*t2^3)/(t1^2*s1^3);$
 $q21 := -(r2^2*t1^2-2*r2*s1*t1*t2+3*s1^2*t2^2)/(s1^2*t1);$
 $s21 := -(2*r2*t1-3*s1*t2)/t1;$
 $\text{zamproc}(p11,q11,t1,0,p21,q21,t2,0, s1,s1,r2,s21):$
 $0, -\frac{3 (t1 r2 - s1 t2)^2}{t1}, 0, \frac{3 (t1 r2 - s1 t2)^2}{t1}$
 $\frac{(t1 r2 - s1 t2)^2}{t1}, 0, 0, \frac{(t1 r2 - s1 t2)^2}{t1}$

$NSF_{32}^{4,1}$

```
> evala([solve([M[1,1],M[1,2],M[2,2],M[2,3]], {p2,q2,r2,s2})]);

$$\left\{ \begin{array}{l} p2 = \frac{3pl^2tl^2 - 4plql^2tl - 6plqltl^2 - 2pltl^2 + ql^4 + 3ql^3t2 + 4ql^2t2^2 + 3qlt2^3 + t2^4}{tl^2(ql+2t2)}, q2 = -\frac{3pltl - ql^2 - 2qlt2 - t2^2}{tl}, r2 = \\ -\frac{s1(ql+t2)}{tl}, s2 = \frac{s1(3pltl - ql^2 + t2^2)}{tl(ql+2t2)} \end{array} \right\}$$

> collect(3*p1^2*t1^2-4*p1*q1^2*t1-6*p1*q1*t1^2-2*p1*t1*t2^2+ql^4+3*ql^3*t2+4*ql^2*t2^2+3*ql*t2^3+t2^4, [p1,t1], factor);

$$3pl^2tl^2 - 2(ql+t2)(2ql+t2)tlpl + (ql^2+qlt2+t2^2)(ql+t2)^2$$

> D = simplify(((2*(q1+t2))*(2*q1+t2))^2 - 12*(q1^2+q1*t2+t2^2)*(q1+t2)^2);

$$D=4(ql+2t2)(ql-t2)(ql+t2)^2$$

> solve(3*z^2-(2*(q1+t2))*(2*q1+t2)*z+(q1^2+q1*t2+t2^2)*(q1+t2)^2, z);

$$\left( \frac{2ql}{3} + \frac{t2}{3} + \frac{\sqrt{ql^2+qlt2-2t2^2}}{3} \right) (ql+t2), \left( \frac{2ql}{3} + \frac{t2}{3} - \frac{\sqrt{ql^2+qlt2-2t2^2}}{3} \right) (ql+t2)$$

> p11 := theta/t1:
p21 := (3*theta^2-(2*(q1+t2))*(2*q1+t2)*theta+(q1^2+q1*t2+t2^2)*(q1+t2)^2)/(t1^2*(q1+2*t2)):
q21 := -(3*p11*t1-ql^2-2*q1*t2-t2^2)/t1:
r21 := -s1*(q1+t2)/t1:
s21 := s1*(3*p11*t1-ql^2-2*t2^2)/(t1*(q1+2*t2)):
zamproc(p11,q1,t1,0,p21,q21,t2,0, s1,s1,r21,s21, full=false):
pm1(p11,q1,t1,0,p21,q21,t2,0, s1,s1,r21,s21);

$$0, 0, -\frac{3(qlt2+t2^2+\theta)(ql^2+qlt2+t2^2-3\theta)sl^2}{tl(ql+2t2)^2}, -\frac{3(qlt2+t2^2+\theta)(ql^2+qlt2+t2^2-3\theta)sl^2}{tl(ql+2t2)^2}$$


$$\frac{(qlt2+t2^2+\theta)sl^2}{tl}, 0, 0, \frac{(qlt2+t2^2+\theta)sl^2}{tl}$$

Resultant of G: 
$$\frac{(qlt2+t2^2+\theta)^2(ql^2+qlt2+t2^2-3\theta)^2}{tl^2(ql+2t2)^2}$$

> simplify(r21 - s21);

$$-\frac{3sl(qlt2+t2^2+\theta)}{tl(ql+2t2)}$$

> s11 := abs(t1)^(1/2)/abs(q1*t2+t2^2+theta)^(1/2):
r21 := -s11*(q1+t2)/t1:
s21 := s11*(3*p11*t1-ql^2-2*t2^2)/(t1*(q1+2*t2)):
zamproc(p11,q1,t1,0,p21,q21,t2,0, s11,s11,r21,s21):

$$0, 0, -\frac{3(qlt2+t2^2+\theta)(ql^2+qlt2+t2^2-3\theta)\left| \frac{tl}{qlt2+t2^2+\theta} \right|}{tl(ql+2t2)^2}, -\frac{3(qlt2+t2^2+\theta)(ql^2+qlt2+t2^2-3\theta)\left| \frac{tl}{qlt2+t2^2+\theta} \right|}{tl(ql+2t2)^2}$$


$$\frac{(qlt2+t2^2+\theta)\left| \frac{tl}{qlt2+t2^2+\theta} \right|}{tl}, 0, 0, \frac{(qlt2+t2^2+\theta)\left| \frac{tl}{qlt2+t2^2+\theta} \right|}{tl}$$

> u = 3*(3*theta-ql^2-q1*t2-t2^2)/(q1+2*t2)^2;

$$u = \frac{3(-ql^2-qlt2-t2^2+3\theta)}{(ql+2t2)^2}$$


```

$NSF_{36}^{4,1}$

```
> evala([solve([M[1,1],M[1,2],M[2,2],M[2,4]], {p2,q2,r2,s2})]);

$$\left\{ \begin{array}{l} p2 = \frac{pl^2tl^2 - 4plql^2tl - 10plqltl^2 - 6pltl^2 - 4ql^3t2 - 16ql^2t2^2 - 21qlt2^3 - 9t2^4}{tl^2(ql+2t2)}, q2 = -\frac{3pltl + 2qlt2 + 3t2^2}{tl}, r2 = \\ -\frac{s1(2ql+3t2)}{tl}, s2 = \frac{s1(pltl + 2qlt2 + 3t2^2)}{tl(ql+2t2)} \end{array} \right\}$$

> collect(p1^2*t1^2-4*p1*q1^2*t1-10*p1*q1*t1*t2-6*p1*t1*t2^2-4*q1^3*t2-16*q1^2*t2^2-21*q1*t2^3-9*t2^4, [p1,t1], factor);

$$pl^2tl^2 - 2(2ql+3t2)(ql+t2)tlpl - t2(ql+t2)(2ql+3t2)^2$$

> solve(z^2-(2*(2*q1+3*t2))*(q1+t2)*z-t2*(q1+t2)*(2*q1+3*t2)^2, z);

$$(ql+t2+\sqrt{ql^2+3qlt2+2t2^2})(2ql+3t2), (ql+t2-\sqrt{ql^2+3qlt2+2t2^2})(2ql+3t2)$$

> p11 := theta/t1:
p21 := (theta^2-(2*(2*q1+3*t2))*(q1+t2)*theta-t2*(q1+t2)*(2*q1+3*t2)^2)/(t1^2*(q1+2*t2)):
q21 := -(3*p11*t1+2*q1*t2+3*t2^2)/t1:
r21 := -s1*(2*q1+3*t2)/t1:
s21 := s1*(p11*t1+2*q1*t2+3*t2^2)/(t1*(q1+2*t2)):
```

```

zamproc(p11,q1,t1,0,p21,q21,t2,0, s1,s1,r21,s21):
pml(p11,q1,t1,0,p21,q21,t2,0, s1,s1,r21,s21);
0, 0,  $\frac{s1^2 (2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta) (q1 t1 t2 + t2^2 + \theta)}{t1 (q1 + 2 t2)^2}$ ,  $\frac{s1^2 (2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta) (q1 t1 t2 + t2^2 + \theta)}{t1 (q1 + 2 t2)^2}$ 
 $\frac{(2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta) s1^2}{t1}$ , 0, -  $\frac{(2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta) s1^2}{t1}$ , 0
Resultant of G:  $\frac{(2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta)^2 (q1 t1 t2 + t2^2 + \theta)^2}{t1^2 (q1 + 2 t2)^2}$ 

> simplify(r21 - s21);
 $\frac{s1 (2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta)}{t1 (q1 + 2 t2)}$ 

> s11 := abs(t1)^(1/2)/abs(2*q1^2+9*q1*t1+9*t1^2+theta)^(1/2):
r21 := -s11*(2*q1+3*t2)/t1:
s21 := s11*(p11*t1+2*q1*t1+3*t1^2)/(t1*(q1+2*t2)):
zamproc(p11,q1,t1,0,p21,q21,t2,0, s11,s11,r21,s21):
0, 0,  $\frac{\frac{t1}{\left| 2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta \right|} \left( q1 t1 t2 + t2^2 + \theta \right) \left( 2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta \right)}{t1 (q1 + 2 t2)^2}$ ,
 $\frac{\frac{t1}{\left| 2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta \right|} \left( q1 t1 t2 + t2^2 + \theta \right) \left( 2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta \right)}{t1 (q1 + 2 t2)^2}$ 
 $\frac{\left( 2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta \right) \frac{t1}{\left| 2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta \right|}}{t1}, 0, \frac{\left( -2 q1 t1^2 - 9 q1 t1 t2 - 9 t2^2 - \theta \right) \frac{t1}{\left| 2 q1 t1^2 + 9 q1 t1 t2 + 9 t2^2 + \theta \right|}}{t1}, 0$ 

> u = (q1*t1+9*t1^2+theta)/(q1+2*t1)^2;
u =  $\frac{q1 t1 + t2^2 + \theta}{(q1 + 2 t2)^2}$ 

```

Результат замены с $r_1 = s_1$ в исходной системе:

```

> M := zamproc(p1,q1,t1,0,0,q2,t2,0, s1,s1,r2,s2):
 $\frac{-s1^2 s2 p1 - s1 s2 r2 q1 + q2 s1^2 r2 + t2 s1 r2^2 - r2^2 s2 t1}{r2 - s2},$ 
 $\frac{(-s1 q1 - 2 r2 t1) s2^2 + \left( -r2^2 t1 - 2 s1 (q1 - t2) r2 - 3 s1^2 \left( p1 - \frac{q2}{3} \right) \right) s2 + 2 q2 s1^2 r2 + t2 s1 r2^2}{r2 - s2},$ 
 $\frac{-s2^3 t1 + ((-2 q1 + t2) s1 - 2 r2 t1) s2^2 - 3 \left( \left( p1 - \frac{2 q2}{3} \right) s1 + \frac{r2 (q1 - 2 t2)}{3} \right) s1 s2 + q2 s1^2 r2}{r2 - s2},$ 
 $\frac{-(s2^2 t1 + s1 (q1 - t2) s2 + s1^2 (p1 - q2)) s2}{r2 - s2}$ 
 $\frac{r2 (r2^2 t1 + s1 (q1 - t2) r2 + s1^2 (p1 - q2))}{r2 - s2}, \frac{r2^3 t1 + ((2 q1 - t2) s1 + 2 s2 t1) r2^2 + 3 \left( \left( p1 - \frac{2 q2}{3} \right) s1 + \frac{s2 (q1 - 2 t2)}{3} \right) s1 r2 - s1^2 s2 q2}{r2 - s2},$ 
 $\frac{(s1 q1 + 2 s2 t1) r2^2 + (s1^2 (3 p1 - q2) + 2 s1 (q1 - t2) s2 + s2^2 t1) r2 - 2 s1^2 s2 q2 - s1 s2^2 t2}{r2 - s2},$ 
 $\frac{p1 r2 s1^2 + s1 s2 r2 q1 - s1^2 s2 q2 + r2 s2^2 t1 - s1 s2^2 t2}{r2 - s2}$ 

```

$NSF_3^{5,1}$

```

> evala([solve([M[1,4],M[2,1],M[2,3]], {t1,s1,r2,s2})]);
 $\left\{ r2 = 0, s1 = s1, s2 = -\frac{2 s1 q2}{t2}, t1 = -\frac{(p1 t2 - 2 q1 q2 + t2 q2) t2}{4 q2^2} \right\}, \{r2=r2, s1=0, s2=s2, t1=0\}, \left\{ r2 = -\frac{s1 (3 p1 - q2)}{q1}, s1 = s1, s2 = 0, t1 = \frac{(2 p1 q1 - 3 p1 t2 + t2 q2) q1}{(3 p1 - q2)^2} \right\}, \{r2=RootOf((q1^2 - q1 t2) \_Z^2 + 2 p1 t2 - 2 p1 q2 + (3 p1 q1 - 3 p1 t2 - q1 q2 + t2 q2) \_Z) s1, s1=s1, s2=RootOf((q1^2 - q1 t2) \_Z^2 + 2 p1 t2 - 2 p1 q2 + (3 p1 q1 - 3 p1 t2 - q1 q2 + t2 q2) \_Z) q1 + 2 p1) s1, t1 = -\frac{1}{4 p1^2} ((q1 - t2) (RootOf((q1^2 - q1 t2) \_Z^2 + 2 p1 t2 - 2 p1 q2 + (3 p1 q1 - 3 p1 t2 - q1 q2 + t2 q2) \_Z) q1^2 - RootOf((q1^2 - q1 t2) \_Z^2 + 2 p1 t2 - 2 p1 q2 + (3 p1 q1 - 3 p1 t2 - q1 q2 + t2 q2) \_Z) q1 t2 + p1 q1 - 3 p1 t2 - q1 q2 + t2 q2)))\}$ 
> evala([solve([M[1,4],M[2,1],M[2,3]], {p1,q1,q2})]);
 $\left\{ \left\{ p1 = \frac{t1 r2^2 - r2 t2 s1 + r2 s2 t1 - s1 s2 t2}{2 s1^2}, q1 = -\frac{r2 t1 - s1 t2 + s2 t1}{s1}, q2 = \frac{t1 r2^2 - r2 t2 s1 - r2 s2 t1 - s1 s2 t2}{2 s1^2} \right\} \right\}$ 
> {r2=-s1*(3*p1-q2)/q1, s1=s1, s2=0, t1=(2*p1*q1-3*p1*t2+q2*t2)*q1/(3*p1-q2)^2};

```

```


$$\left\{ r2 = -\frac{s1(3pl-q2)}{q1}, s1=s1, s2=0, tl = \frac{(2plq1-3plt2+t2q2)q1}{(3pl-q2)^2} \right\}$$

> t11 := (2*p1*q1-3*p1*t2+q2*t2)*q1/(3*p1-q2)^2:
r21 := -s1*(3*p1-q2)/q1:
zamproc(p1,q1,t11,0,0,q2,t2,0, s1,s1,r21,0):
pm1(p1,q1,t11,0,0,q2,t2,0, s1,s1,r21,0);

$$-\frac{3s1^2 \left( -\frac{q2 q1}{3} + t2 \left( pl - \frac{q2}{3} \right) \right)}{q1}, -\frac{3s1^2 \left( -\frac{2 q2 q1}{3} + t2 \left( pl - \frac{q2}{3} \right) \right)}{q1}, q2 s1^2, 0$$


$$0, -pl s1^2, 0, pl s1^2$$

Resultant of G: 
$$\frac{(3plt2-2q2q1-q2t2)pl^2(3plt2-q2q1-q2t2)}{(3pl-q2)^2}$$

> s11 := abs(p1)^(-1/2):
r21 := -s11*(3*p1-q2)/q1:
zamproc(p1,q1,t11,0,0,q2,t2,0, s11,s11,r21,0):

$$\frac{q1 q2 - 3 t2 \left( pl - \frac{q2}{3} \right)}{q1 |pl|}, \frac{2 q1 q2 - 3 t2 \left( pl - \frac{q2}{3} \right)}{q1 |pl|}, \frac{q2}{|pl|}, 0$$


$$0, -\frac{pl}{|pl|}, 0, \frac{pl}{|pl|}$$

> u = -(q1*q2+t2*(q2-3*p1))/(q1*p1);
v = -(2*q1*q2-t2*(q2-3*p1))/(q1*p1);

$$u = -\frac{q1 q2 + t2 (-3 pl + q2)}{pl q1}$$


$$v = -\frac{2 q1 q2 - t2 (-3 pl + q2)}{pl q1}$$

> {r2=0, s1=s1, s2=-2*s1*q2/t2, t1=- (p1*t2-2*q1*q2+q2*t2)*t2/(4*q2^2)};

$$\left\{ r2 = 0, s1 = s1, s2 = -\frac{2 s1 q2}{t2}, tl = -\frac{(pl t2 - 2 q1 q2 + t2 q2) t2}{4 q2^2} \right\}$$

> t11 := -(p1*t2-2*q1*q2+q2*t2)*t2/(4*q2^2):
s21 := -2*s1*q2/t2:
zamproc(p1,q1,t11,0,0,q2,t2,0, s1,s1,0,s21):
pm1(p1,q1,t11,0,0,q2,t2,0, s1,s1,0,s21);

$$pl s1^2, \frac{s1^2 (3 pl t2 - 2 q2 q1 - q2 t2)}{t2}, \frac{2 s1^2 \left( \left( pl - \frac{q2}{2} \right) t2 - q2 q1 \right)}{t2}, 0$$


$$0, q2 s1^2, 0, -q2 s1^2$$

Resultant of G: 
$$\frac{pl t2 (3 pl t2 - 2 q2 q1 - q2 t2)}{4}$$

> s11 := abs(q2)^(-1/2):
s21 := -2*s11*q2/t2:
zamproc(p1,q1,t11,0,0,q2,t2,0, s11,s11,0,s21):

$$\frac{pl}{|q2|}, \frac{t2 (3 pl - q2) - 2 q1 q2}{|q2| t2}, \frac{(2 pl - q2) t2 - 2 q1 q2}{|q2| t2}, 0$$


$$0, \frac{q2}{|q2|}, 0, -\frac{q2}{|q2|}$$

> u = p1/q2;
v = (t2*(3*p1-q2)-2*q1*q2)/(q2*t2);

$$u = \frac{pl}{q2}$$


$$v = \frac{t2 (3 pl - q2) - 2 q1 q2}{t2 q2}$$

> factor([[p1 = (r2^2*t1-r2*s1*t2+r2*s2*t1-s1*s2*t2)/(2*s1^2), q1 = -(r2*t1-s1*t2+s2*t1)/s1, q2 = (r2^2*t1-r2*s1*t2-r2*s2*t1-s1*s2*t2)/(2*s1^2)]]);

$$\left[ \left\{ pl = \frac{(r2+s2)(r2 t1 - s1 t2)}{2 s1^2}, q1 = -\frac{r2 t1 - s1 t2 + s2 t1}{s1}, q2 = \frac{t1 r2^2 - r2 t2 s1 - r2 s2 t1 - s1 s2 t2}{2 s1^2} \right\} \right]$$

> r21 := solve(q1 = -(r2*t1-s1*t2+s2*t1)/s1, r2):
s21 := solve(pl = (r21+s2)*(r21*t1-s1*t2)/(2*s1^2), s2);
r21 := simplify(-(q1*s1-s1*t2+s21*t1)/t1);

$$s21 := \frac{s1 (2 pl t1 - ql^2 + ql t2)}{t1 (ql - t2)}$$


```



```

+ (4 q1 t2 - 5 t1 q2 - 2 t2^2) _Z + (2 q1 q2 + q2 t2) _Z^2) t1 t2 + 18 q1^2 t2^2 - 43 q1 q2 t1 t2 - 9 q1 t2^3 + 25 q2^2 t1^2 + 9 q2 t1 t2^2), r2 =
-  $\frac{1}{3 t1} (s2 (RootOf(q2^2 _Z^3 - t1 t2 + (4 q1 t2 - 5 t1 q2 - 2 t2^2) _Z + (2 q1 q2 + q2 t2) _Z^2)^2 q2 + 2 RootOf(q2^2 _Z^3 - t1 t2 + (4 q1 t2 - 5 t1 q2 - 2 t2^2) _Z + (2 q1 q2 + q2 t2) _Z^2) t2 + t1)), s1$ 
= RootOf(q2^2 _Z^3 - t1 t2 + (4 q1 t2 - 5 t1 q2 - 2 t2^2) _Z + (2 q1 q2 + q2 t2) _Z^2) s2, s2=s2\} \]
> {p1=4*q2*(q1*t2-q2*t1)/(3*t2^2), q1=q1, r2=0, s1=s1, s2=-2*s1*q2/t2};
    \{p1 =  $\frac{4 q2 (q1 t2 - t1 q2)}{3 t2^2}$ , q1 = q1, r2 = 0, s1 = s1, s2 = - $\frac{2 s1 q2}{t2}$  \}
> p11 := 4*q2*(q1*t2-q2*t1)/(3*t2^2): s21 := -2*s1*q2/t2:
zamproc(p11,q1,t1,0,0,q2,t2,0, s1,s1,0,s21):

$$\frac{4 s1^2 q2 (q1 t2 - t1 q2)}{3 t2^2}, \frac{q2 s1^2 (2 q1 t2 - 4 t1 q2 - t2^2)}{t2^2}, 0, -\frac{2 s1^2 \left(q1 t2 - 4 t1 q2 - \frac{3}{2} t2^2\right) q2}{3 t2^2}$$

0, q2 s1^2, 0, -q2 s1^2
> s11 := abs(q2)^(-1/2): s21 := -2*s11*q2/t2:
zamproc(p11,q1,t1,0,0,q2,t2,0, s11,s11,0,s21):

$$\frac{4 q2 (q1 t2 - t1 q2)}{3 |q2| t2^2}, \frac{q2 (2 q1 t2 - 4 t1 q2 - t2^2)}{|q2| t2^2}, 0, -\frac{2 \left(q1 t2 - 4 t1 q2 - \frac{3}{2} t2^2\right) q2}{3 |q2| t2^2}$$

0,  $\frac{q2}{|q2|}$ , 0, - $\frac{q2}{|q2|}$ 
> u = 4*q2*(q1*t2-q2*t1)/(3*q2*t2^2);
v = q2*(2*q1*t2-4*q2*t1-t2^2)/(q2*t2^2);
u =  $\frac{4 (q1 t2 - t1 q2)}{3 t2^2}$ 
v =  $\frac{2 q1 t2 - 4 t1 q2 - t2^2}{t2^2}$ 
> {p1=p1, s1=r2*q1/q2, s2=-3*r2, t1=-q1^2*(3*p1-5*q2)/(3*q2^2), t2=5*q1*(1/3)};
    \{p1 = p1, s1 =  $\frac{r2 q1}{q2}$ , s2 = -3 r2, t1 = - $\frac{q1^2 (3 p1 - 5 q2)}{3 q2^2}$ , t2 =  $\frac{5 q1}{3}$  \}
> t11 := -q1^2*(3*p1-5*q2)/(3*q2^2): t21 := 5*q1*(1/3):
s21 := -3*r2: s11 := r2*q1/q2:
zamproc(p1,q1,t11,0,0,q2,t21,0, s11,s11,r2,s21):

$$\frac{8 r2^2 q1^2}{3 q2}, \frac{2 r2^2 q1^2 (9 p1 - 14 q2)}{3 q2^2}, 0, -\frac{6 r2^2 q1^2 (p1 - 2 q2)}{q2^2}$$

0,  $\frac{2 p1 r2^2 q1^2}{q2^2}$ , 0, - $\frac{2 p1 r2^2 q1^2}{q2^2}$ 
> r21 := q2/(sqrt(2)*q1*abs(p1)^(1/2)):
s21 := -3*r21: s11 := r21*q1/q2:
zamproc(p1,q1,t11,0,0,q2,t21,0, s11,s11,r21,s21):

$$\frac{4 q2}{3 |p1|}, \frac{9 p1 - 14 q2}{3 |p1|}, 0, \frac{-3 p1 + 6 q2}{|p1|}$$

0,  $\frac{p1}{|p1|}$ , 0, - $\frac{p1}{|p1|}$ 
> u = 4*q2/(3*p1); v = (9*p1-14*q2)/(3*p1);
u =  $\frac{4 q2}{3 p1}$ 
v =  $\frac{9 p1 - 14 q2}{3 p1}$ 
> evala([solve(M[2,1], {p1,q1,t1,q2,t2,s1,r2,s2})]);
\{p1=p1, q1=q1, q2=q2, r2=0, s1=s1, s2=s2, t1=t1, t2=t2\}, \{p1 = - $\frac{q1 r2 s1 - q2 s1^2 + r2^2 t1 - r2 s1 t2}{s1^2}$ , q1 = q1, q2 = q2, r2 = r2, s1 = s1, s2 = s2,
t1 = t1, t2 = t2\}
> N := zamproc(p1,q1,t1,0,0,q2,t2,0, s1,s1,0,s2):

$$p1 s1^2, s1^2 (3 p1 - q2) + q1 s1 s2, (3 p1 - 2 q2) s1^2 + 2 \left(q1 - \frac{t2}{2}\right) s2 s1 + s2^2 t1, s2^2 t1 + s1 (q1 - t2) s2 + s1^2 (p1 - q2)$$

0, q2 s1^2, 2 q2 s1^2 + s1 s2 t2, s1 (s1 q2 + s2 t2)

```

```

> evala([solve([N[1,3], N[2,3]], {p1,s1,s2})]);

$$\left[ \{p1=p1, s1=0, s2=0\}, \left\{ p1 = \frac{4 q2 (q1 t2 - q2 t1)}{3 t2^2}, s1=s1, s2=-\frac{2 s1 q2}{t2} \right\} \right]$$

> r21 := eta*s1: s21 := theta*s1:
p11 := simplify(-(q1*r21*s1-q2*s1^2+r21^2*t1-r21*s1*t2)/s1^2);
N := zamproc(p11,q1,t1,0,0,q2,t2,0, s1,s1,r21,s21):
p11 := -eta^2*t1 + (-q1 + t2)*eta + q2
(eta*t2 + q2)*s1^2, s1^2 ((2*eta*t1 + q1)*theta + eta*t2 + 2*q2), (3*eta*t1*theta + t1*theta^2 + 2*theta*q1 - theta*t2 + q2)*s1^2, ((eta + theta)*t1 + q1 - t2)*theta*s1^2
0, -s1^2 (2*eta^2*t1 + (q1 - 2*t2)*eta - q2), -2 * (3*eta^2*t1/2 + (theta*t1/2 + q1 - t2/2) * eta - theta*t2/2 - q2) * s1^2, -s1^2 (eta^2*t1 + (theta*t1 + q1 - t2)*eta - theta*t2 - q2)
> evala([solve(N[1,3], {q1,t1,t2,s1,eta,theta})]);

$$\left[ \{\eta=\eta, q1=q1, s1=0, t1=t1, t2=t2, \theta=\theta\}, \left\{ \eta = -\frac{t1\theta^2 + 2\theta q1 - \theta t2 + q2}{3\theta t1}, q1=q1, s1=s1, t1=t1, t2=t2, \theta=\theta \right\} \right]$$

> etal := -(t1*theta^2+2*q1*theta-t2*theta+q2)/(3*theta*t1):
r21 := etal*s1: s21 := theta*s1:
p11 := simplify(-(q1*r21*s1-q2*s1^2+r21^2*t1-r21*s1*t2)/s1^2);
N := zamproc(p11,q1,t1,0,0,q2,t2,0, s1,s1,r21,s21):
p11(p11,q1,t1,0,0,q2,t2,0);
p11 :=  $\frac{-t1^2\theta^4 - t1(q1+t2)\theta^3 + (2q1^2 - 5q1t2 + 7q2t1 + 2t2^2)\theta^2 - q2(q1+t2)\theta - q2^2}{9t1\theta^2}$ 
-  $\frac{s1^2(t1t2\theta^2 + 2q1t2\theta - 3q2t1\theta - t2^2\theta + q2t2)}{3t1\theta}, - \frac{s1^2(2\theta^3t1^2 + t1(q1-t2)\theta^2 + (2q1t2 - 4q2t1 - t2^2)\theta + q2t2)}{3t1\theta}, 0,$ 

$$0, - \frac{s1^2(2t1\theta^2 + (q1 - 2t2)\theta - q2)}{3},$$


$$0, - \frac{2s1^2 \left( t1^2\theta^4 + \frac{5t1\left(q1 + \frac{2t2}{5}\right)\theta^3}{2} + \left(-\frac{5q2t1}{2} + (q1 + 4t2)\left(q1 - \frac{t2}{2}\right)\right)\theta^2 + \frac{5q2\left(q1 + \frac{2t2}{5}\right)\theta}{2} + q2^2\right)}{9t1\theta^2},$$


$$- \frac{(-t1t2\theta^3 + 4q1t2\theta^2 - 5q2t1\theta^2 - 2t2^2\theta^2 + 2q1q2\theta + q2t2\theta + q2^2)s1^2}{3t1\theta^2},$$


$$- \frac{2\left(t1^2\theta^4 + \frac{5t1(q1+t2)\theta^3}{2} + \left(5q2t1 + \left(q1 - \frac{t2}{2}\right)(q1 - 2t2)\right)\theta^2 - \frac{q2(q1+t2)\theta}{2} - \frac{q2^2}{2}\right)s1^2}{9t1\theta^2}$$

Resultant of G:  $\frac{1}{81t1^2\theta^4} ((-t1t2\theta^2 + q1t2\theta - 3q2t1\theta - 2t2^2\theta - q2t2) (t1t2\theta^2 + 2q1t2\theta - 3q2t1\theta - t2^2\theta + q2t2) (-t1^2\theta^4 - q1t1\theta^3 - t1t2\theta^3 + 2q1^2\theta^2 - 5q1t2\theta^2 + 7q2t1\theta^2 + 2t2^2\theta^2 - q1q2\theta - q2t2\theta - q2^2))$ 
> collect((-t1*t2*theta^3+4*q1*t2*theta^2-5*q2*t1*theta^2-2*t2^2*theta+q2*t2)^2, theta, factor);
t1*t2*theta^3 + (-4*q1*t2+5*q2*t1+2*t2^2)*theta^2 - q2*(2*q1+t2)*theta - q2^2
> b2+d2 = collect(simplify(-(2*s1^2*(t1^2*theta^4+5*t1*(q1+2*t2*(1/5)))*theta^3*(1/2)+(-5*q2*t1*(1/2)+(q1+4*t2)*(q1-(1/2)*t2))*theta^2+5*q2*(q1+2*t2*(1/5))*theta^3*(1/2)+q2^2)), 2*s1^2*(t1^2*theta^4+5*t1*(q1+2*t2)*(q1-(1/2)*t2))*theta^2-(1/2)*q2*(q1+t2)*theta-(1/2)*q2^2), theta, factor);
b2+d2 = 3*s1^2*t1*t2*theta^3 - 3*(4*q1*t2 - 5*q2*t1 - 2*t2^2)*s1^2*theta^2 - 3*q2*(2*q1+t2)*s1^2*theta - 3*s1^2*q2^2
NSF75,1
> evala([solve(M[1,4], {p1,q1,t1,q2,t2,s1,r2,s2})]);

$$\left[ \{p1=p1, q1=q1, q2=q2, r2=r2, s1=s1, s2=0, t1=t1, t2=t2\}, \left\{ p1 = -\frac{q1 s1 s2 - q2 s1^2 - s1 s2 t2 + s2^2 t1}{s1^2}, q1=q1, q2=q2, r2=r2, s1=s1, s2=s2, t1=t1, t2=t2 \right\} \right]$$

> N := zamproc(p1,q1,t1,0,0,q2,t2,0, s1,s1,r2,0):
s1*(s1*q2+r2*t2), 2*q2*s1^2+r2*s1*t2, q2*s1^2, 0
r2^2*t1+s1*(q1-t2)*r2+s1^2*(p1-q2), (3*p1-2*q2)*s1^2+2*(q1 - t2/2)*r2*s1+r2^2*t1, s1^2*(3*p1-q2)+q1*r2*s1, p1*s1^2
> evala([solve([N[2,2],N[2,3]], {t1,s1,r2}))];

$$\left[ \{r2=0, s1=0, t1=t1\}, \{r2=r2, s1=0, t1=0\}, \left\{ r2 = -\frac{s1(3p1 - q2)}{q1}, s1=s1, t1 = \frac{q1(3p1q1 - 3p1t2 + q2t2)}{9p1^2 - 6p1q2 + q2^2} \right\} \right]$$


```

```

> t11 := q1*(3*p1*q1-3*p1*t2+q2*t2)/(9*p1^2-6*p1*q2+q2^2):
r21 := -s1*(3*p1-q2)/q1:
zamproc(p1,q1,t11,0,0,q2,t2,0, s1,s1,r21,0):
  
$$-\frac{3 s l^2 \left(-\frac{q^2 q l}{3}+t_2 \left(p l-\frac{q^2}{3}\right)\right)}{q l}, -\frac{3 \left(-\frac{2 q^2 q l}{3}+t_2 \left(p l-\frac{q^2}{3}\right)\right) s l^2}{q l}, q_2 s l^2, 0$$

  
$$p l s l^2, 0, 0, p l s l^2$$


> s11 := abs(p1)^(-1/2): r21 := -s11*(3*p1-q2)/q1:
zamproc(p1,q1,t11,0,0,q2,t2,0, s11,s11,r21,0):
  
$$\frac{q_2 q l-3 t_2 \left(p l-\frac{q^2}{3}\right)}{q l|p l|}, \frac{2 q_2 q l-3 t_2 \left(p l-\frac{q^2}{3}\right)}{q l|p l|}, \frac{q_2}{|p l|}, 0$$

  
$$\frac{p l}{|p l|}, 0, 0, \frac{p l}{|p l|}$$


> u = (q2*q1-3*t2*(p1-(1/3)*q2))/(q1*p1);
v = (2*q2*q1-3*t2*(p1-(1/3)*q2))/(q1*p1);
  
$$u=\frac{q_2 q l-3 t_2 \left(p l-\frac{q^2}{3}\right)}{p l q l}$$

  
$$v=\frac{2 q_2 q l-3 t_2 \left(p l-\frac{q^2}{3}\right)}{p l q l}$$


> r21 := theta*s1: s21 := eta*s1:
p11 := simplify(-(q1*s1*s21-q2*s1^2-s1*s21*t2+s21^2*t1)/s1^2);
zamproc(p11,q1,t1,0,0,q2,t2,0, s1,s1,r21,s21):
  
$$p_{11} := -\eta^2 t l + (-q l + t_2) \eta + q_2$$

  
$$-s l^2 (\eta^2 t l + (t l \theta + q l - t_2) \eta - t_2 \theta - q_2), -2 s l^2 \left(\frac{3 \eta^2 t l}{2} + \left(\frac{t l \theta}{2} + q l - \frac{3 t_2}{2}\right) \eta - \frac{t_2 \theta}{2} - q_2\right), -s l^2 (2 \eta^2 t l + (q l - 2 t_2) \eta - q_2), 0$$

  
$$s l^2 ((\eta + \theta) t l + q l - t_2) \theta, (3 \eta t l \theta + t l \theta^2 + 2 \theta q l - t_2 \theta + q_2) s l^2, ((2 t l \eta + q l) \theta + \eta t_2 + 2 q_2) s l^2, (\eta t_2 + q_2) s l^2$$


> etal := solve(3*eta*t1*theta+t1*theta^2+2*q1*theta-t2*theta+q2, eta);
  
$$\eta_l := -\frac{t l \theta^2 + 2 \theta q l - t_2 \theta + q_2}{3 \theta t l}$$


> r21 := theta*s1: s21 := etal*s1:
p11 := simplify(-(q1*s1*s21-q2*s1^2-s1*s21*t2+s21^2*t1)/s1^2);
zamproc(p11,q1,t1,0,0,q2,t2,0, s1,s1,r21,s21):
  
$$p_{11} := \frac{-t l^2 \theta^4 - t l (q l + t_2) \theta^3 + (2 q l^2 - 5 q l t_2 + 7 q_2 t l + 2 t_2^2) \theta^2 - q_2 (q l + t_2) \theta - q_2^2}{9 t l \theta^2}$$

  
$$\frac{2 \left(t l^2 \theta^4 + \frac{5 t l (q l + t_2) \theta^3}{2} + \left(5 q_2 t l + \left(q l - \frac{t_2}{2}\right) (q l - 2 t_2)\right) \theta^2 - \frac{q_2 (q l + t_2) \theta}{2} - \frac{q_2^2}{2}\right) s l^2}{9 t l \theta^2},$$

  
$$\frac{(-t l t_2 \theta^3 + 4 q l t_2 \theta^2 - 5 q_2 t l \theta^2 - 2 t_2^2 \theta^2 + 2 q l q_2 \theta + q_2 t_2 \theta + q_2^2) s l^2}{3 t l \theta^2},$$

  
$$-\frac{2 s l^2 \left(t l^2 \theta^4 + \frac{5 t l \left(q l + \frac{2 t_2}{5}\right) \theta^3}{2} + \left(-\frac{5 q_2 t l}{2} + (q l + 4 t_2) \left(q l - \frac{t_2}{2}\right)\right) \theta^2 + \frac{5 q_2 \left(q l + \frac{2 t_2}{5}\right) \theta}{2} + q_2^2\right)}{9 t l \theta^2}, 0$$

  
$$\frac{s l^2 (2 t l \theta^2 + (q l - 2 t_2) \theta - q_2)}{3}, 0, -\frac{s l^2 (2 \theta^3 t l^2 + t l (q l - t_2) \theta^2 + (2 q l t_2 - 4 q_2 t l - t_2^2) \theta + q_2 t_2)}{3 t l \theta},$$

  
$$-\frac{s l^2 (t l t_2 \theta^2 + 2 q l t_2 \theta - 3 q_2 t l \theta - t_2^2 \theta + q_2 t_2)}{3 t l \theta}$$


Resultant of G: 
$$\frac{1}{81 t l^2 \theta^4} ((-t l t_2 \theta^2 + q l t_2 \theta - 3 q_2 t l \theta - 2 t_2^2 \theta - q_2 t_2) (t l t_2 \theta^2 + 2 q l t_2 \theta - 3 q_2 t l \theta - t_2^2 \theta + q_2 t_2) (-t l^2 \theta^4 - q l t l \theta^3 - t l t_2 \theta^3 + 2 q l^2 \theta^2 - 5 q l t_2 \theta^2 + 7 q_2 t l \theta^2 + 2 t_2^2 \theta^2 - q l q_2 \theta - q_2 t_2 \theta - q_2^2))$$


> a2-d2=simplify((1/3)*s1^2*(2*t1*theta^2+(q1-2*t2)*theta-q2)+(s1^2*(t1*t2*theta^2+2*q1*t2*theta-3*q2*t1*theta-t2^2*theta+q2*t2))/(3*t1^2*theta));
  
$$a2 - d2 = \frac{s l^2 (2 \theta^3 t l^2 + t l (q l - t_2) \theta^2 + (2 q l t_2 - 4 q_2 t l - t_2^2) \theta + q_2 t_2)}{3 t l \theta}$$


```