Summary of symmetry calculations

October 26, 2021

Contents

Chapter 1

DBH_model

Run 02_05PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\begin{aligned}\frac{\mathrm{d}w_1}{\mathrm{d}t} &= -w_1w_2 - w_1w_3 + w_2w_3,\\ \frac{\mathrm{d}w_2}{\mathrm{d}t} &= -w_1w_2 + w_1w_3 - w_2w_3,\\ \frac{\mathrm{d}w_3}{\mathrm{d}t} &= w_1w_2 - w_1w_3 - w_2w_3.\end{aligned}$$

The calculated generators are:

$$X_1 = (1)\,\partial t,$$

$$X_2 = (-1)\,\partial t,$$

$$\begin{aligned}X_3 = {} & (t+2)\,\partial t + (1-2tw_1)\,\partial w_1 + (1-2tw_2)\,\partial w_2\\ & + (1-2tw_3)\,\partial w_3\end{aligned}$$

$$X_4 = (-1+t)\,\partial t + (w_1)\,\partial w_1 + (w_2)\,\partial w_2 + (w_3)\,\partial w_3,$$

$$\begin{aligned}X_5 = {} & (t)\,\partial t + (w_2w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t))\,\partial w_1 + (w_1w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t)\\ & + -w_2w_3\,\mathrm{f}_1(t))\,\partial w_2 + (w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t) - w_2w_3\,\mathrm{f}_1(t))\,\partial w_3\end{aligned}$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

The execution time of the script was:

0 hours 5 minutes 5 seconds.

Run 02_10PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\begin{aligned}\frac{\mathrm{d}w_1}{\mathrm{d}t} &= -w_1w_2 - w_1w_3 + w_2w_3,\\ \frac{\mathrm{d}w_2}{\mathrm{d}t} &= -w_1w_2 + w_1w_3 - w_2w_3,\\ \frac{\mathrm{d}w_3}{\mathrm{d}t} &= w_1w_2 - w_1w_3 - w_2w_3.\end{aligned}$$

The calculated generators are:

$$X_1 = (-1)\,\partial t,$$

$$\begin{aligned}X_2 = {} & (t+2)\,\partial t + (1-2tw_1)\,\partial w_1 + (1-2tw_2)\,\partial w_2\\ & + (1-2tw_3)\,\partial w_3\end{aligned}$$

$$X_3 = (-1+t)\,\partial t + (w_1)\,\partial w_1 + (w_2)\,\partial w_2 + (w_3)\,\partial w_3,$$

$$X_4 = (1)\,\partial t,$$

$$\begin{aligned}X_5 = {} & (t)\,\partial t + (w_2w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t))\,\partial w_1 + (w_1w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t)\\ & + -w_2w_3\,\mathrm{f}_1(t))\,\partial w_2 + (w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t) - w_2w_3\,\mathrm{f}_1(t))\,\partial w_3\end{aligned}$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

The execution time of the script was:

0 hours 5 minutes 16 seconds.

Run 03_04PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\begin{aligned}\frac{\mathrm{d}w_1}{\mathrm{d}t} &= -w_1w_2 - w_1w_3 + w_2w_3,\\ \frac{\mathrm{d}w_2}{\mathrm{d}t} &= -w_1w_2 + w_1w_3 - w_2w_3,\\ \frac{\mathrm{d}w_3}{\mathrm{d}t} &= w_1w_2 - w_1w_3 - w_2w_3.\end{aligned}$$

The calculated generators are:

$$X_1 = (1)\,\partial t,$$

$$X_2 = (-1)\,\partial t,$$

$$\begin{aligned}X_3 = {} & (t+2)\,\partial t + (1-2tw_1)\,\partial w_1 + (1-2tw_2)\,\partial w_2\\ & + (1-2tw_3)\,\partial w_3\end{aligned}$$

$$X_4 = (-1+t)\,\partial t + (w_1)\,\partial w_1 + (w_2)\,\partial w_2 + (w_3)\,\partial w_3,$$

$$\begin{aligned}X_5 = {} & (t)\,\partial t + (w_2w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t))\,\partial w_1 + (w_1w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t)\\ & + -w_2w_3\,\mathrm{f}_1(t))\,\partial w_2 + (w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t) - w_2w_3\,\mathrm{f}_1(t))\,\partial w_3\end{aligned}$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

The execution time of the script was:

0 hours 5 minutes 5 seconds.

Run 04_05PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\begin{aligned}\frac{\mathrm{d}w_1}{\mathrm{d}t} &= -w_1w_2 - w_1w_3 + w_2w_3,\\ \frac{\mathrm{d}w_2}{\mathrm{d}t} &= -w_1w_2 + w_1w_3 - w_2w_3,\\ \frac{\mathrm{d}w_3}{\mathrm{d}t} &= w_1w_2 - w_1w_3 - w_2w_3.\end{aligned}$$

The calculated generators are:

$$X_1 = (-1+t)\,\partial t + (w_1)\,\partial w_1 + (w_2)\,\partial w_2 + (w_3)\,\partial w_3,$$

$$X_2 = (-1)\,\partial t,$$

$$\begin{aligned}X_3 = {} & (t+2)\,\partial t + (1-2tw_1)\,\partial w_1 + (1-2tw_2)\,\partial w_2\\ & + (1-2tw_3)\,\partial w_3\end{aligned}$$

$$X_4 = (1)\,\partial t,$$

$$\begin{aligned}X_5 = {} & (t)\,\partial t + (w_2w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t))\,\partial w_1 + (w_1w_3\,\mathrm{f}_1(t) - w_1w_2\,\mathrm{f}_1(t)\\ & + -w_2w_3\,\mathrm{f}_1(t))\,\partial w_2 + (w_1w_2\,\mathrm{f}_1(t) - w_1w_3\,\mathrm{f}_1(t) - w_2w_3\,\mathrm{f}_1(t))\,\partial w_3\end{aligned}$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

The execution time of the script was:

0 hours 5 minutes 10 seconds.

Chapter 2

linear_model

Run 03_21PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\begin{aligned}\frac{\mathrm{d}u}{\mathrm{d}t} &= u + v,\\ \frac{\mathrm{d}v}{\mathrm{d}t} &= u + v.\end{aligned}$$

The calculated generators are:

$$X_1 = \left(\frac{u}{2} - \frac{v}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2}\right)\partial t$$

$$X_2 = \left(\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial u + \left(-\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial v$$

$$X_3 = \left(-\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial u + \left(\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial v$$

$$\begin{aligned}X_4 = \Bigg(&-\frac{3v}{8} + \frac{u}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-4t}}{8}\\ &+ -\frac{ve^{-2t}}{8} + \frac{ue^{2t}}{8}\Bigg)\partial t + \Bigg(-\frac{v^2}{4} + \frac{u^2}{4} - \frac{uv}{2} - \frac{v^2e^{2t}}{2}\\ &+ -\frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\Bigg)\partial u + \left(-\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v\end{aligned}$$

$$\begin{aligned}X_5 = \Bigg(&\frac{u^2}{4} + \frac{v^2}{4} + \frac{v^2e^{-2t}}{2} - \frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4}\\ &+ \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\Bigg)\partial t\end{aligned}$$

$$X_6 = (1)\,\partial t,$$

$$X_7 = \left(-\frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ve^{2t}}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2}\right)\partial u + \left(\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_8 = \left(-\frac{e^{2t}}{4} + \frac{e^{-2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} - \frac{ve^{2t}}{2}\right)\partial u + \left(\frac{v}{2} - \frac{ve^{2t}}{2}\right)\partial v$$

$$X_9 = \left(-\frac{1}{2} - \frac{e^{-2t}}{4} - \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2} + -\frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} - \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{10} = \left(-\frac{1}{2} + \frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} + \frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{11} = \left(\frac{v}{2} - \frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2}\right)\partial t$$

$$X_{12} = \left(-\frac{5v}{8} + \frac{3u}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{13} = \left(-\frac{u}{8} + \frac{3v}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{2t}}{8} + \frac{ve^{-4t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} - \frac{v^2e^{2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{14} = \left(-\frac{u}{8} - \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{ve^{-4t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_{15} = \left(\frac{u}{8} + \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{v^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2} \right) \partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_{16} = \left(-\frac{3u}{8} + \frac{5v}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{u^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2} \right) \partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_{17} = \left(-\frac{u^2}{4} - \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial t$$

$$X_{18} = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{u^2e^{-2t}}{2} - \frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial t$$

$$X_{19} = \Bigg(u\,\mathrm{f}_2(t) + v\,\mathrm{f}_1(t) - v\,\mathrm{f}_2(t) + \frac{u\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{8} + \frac{u\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{8} + \frac{v\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{8}$$
$$+ \frac{v\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{8} - \frac{3ve^{-2t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{8} - \frac{3ve^{-2t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{8} - \frac{ue^{-4t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{8} - \frac{ue^{2t}\int_0^t \mathrm{c}_{22}$$
$$+ -\frac{ue^{2t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{8} - \frac{ve^{-4t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{8} - \frac{ve^{-4t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{8} + \frac{ue^{-2t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{8} + \frac{ue^{-2t}\int_0^t$$
$$+ \frac{3ve^{2t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{8} + \mathrm{f}_3(t) \Bigg)\,\partial t + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t)\right.$$
$$+ -v^2\,\mathrm{f}_2(t) - \frac{u^2\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{4} - \frac{u^2\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{4} + \frac{v^2\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{4} + \frac{v^2\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{4} + uv\,\mathrm{f}_1(t)$$
$$+ \frac{uv\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{2} + \frac{uv\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{2} + \frac{u^2e^{-2t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{2} + \frac{u^2e^{-2t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{2} + \frac{v^2e^{2t}\int_0^t \mathrm{c}_{22}($$
$$+ -\frac{v^2e^{-2t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{2} - \frac{v^2e^{-2t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{2} - \frac{u^2e^{-4t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{4} - \frac{u^2e^{-4t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{4} - -$$
$$+ -\frac{uve^{-4t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{2} - \frac{uve^{-4t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{2} \Bigg)\,\partial u + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t)\right.$$
$$+ \frac{v^2\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{2} + \frac{v^2\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,ds}{2} - v^2\,\mathrm{f}_2(t) + uv\,\mathrm{f}_1(t) + \frac{v^2e^{2t}\int_0^t \mathrm{c}_{22}(s)e^{-2s}\,ds}{2} + \frac{v^2e^{2t}\int_0^t \left(-\mathrm{c}_{22}(s)e^{-2s}\right)\,$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$
$$\mathrm{f}_2$$
$$\mathrm{f}_3$$

The execution time of the script was:

0 hours 1 minutes 6 seconds.

Run 03_34PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}u}{\mathrm{d}t} = u + v,$$
$$\frac{\mathrm{d}v}{\mathrm{d}t} = u + v.$$

The calculated generators are:

$$X_1 = \left(-\frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ve^{2t}}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2}\right)\partial u + \left(\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_2 = (1)\,\partial t,$$

$$X_3 = \left(\frac{u}{2} - \frac{v}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2}\right)\partial t$$

$$X_4 = \left(\frac{u}{8} + \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{v^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_5 = \left(-\frac{u}{8} + \frac{3v}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{2t}}{8} + \frac{ve^{-4t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} - \frac{v^2e^{2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_6 = \left(-\frac{5v}{8} + \frac{3u}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_7 = \left(-\frac{3v}{8} + \frac{u}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{v^2e^{2t}}{2} - \frac{uv}{2} + -\frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2} \right) \partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_8 = \left(-\frac{3u}{8} + \frac{5v}{8} - \frac{5ue^{-2t}}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ve^{-4t}}{8} + -\frac{ve^{-2t}}{8} + \frac{ue^{2t}}{8} \right) \partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{v^2e^{-2t}}{2} + -\frac{u^2e^{-2t}}{2} - \frac{v^2e^{2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2} \right) \partial u + \left(\frac{v^2}{2} + -\frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_9 = \left(\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial u + \left(-\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial v$$

$$X_{10} = \left(-\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial u + \left(\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial v$$

$$X_{11} = \left(-\frac{1}{2} - \frac{e^{-2t}}{4} - \frac{e^{2t}}{4} \right) \partial t + \left(-\frac{u}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2} + -\frac{ve^{2t}}{2} \right) \partial u + \left(-\frac{v}{2} - \frac{ve^{2t}}{2} \right) \partial v$$

$$X_{12} = \left(-\frac{u^2}{4} - \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial t$$

$$X_{13} = \left(\frac{v}{2} - \frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} \right) \partial t$$

$$X_{14} = \left(-\frac{u}{8} - \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{ve^{-4t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_{15} = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{v^2 e^{-2t}}{2} - \frac{uv}{2} - \frac{u^2 e^{-2t}}{2} + \frac{u^2 e^{-4t}}{4} + \frac{v^2 e^{-4t}}{4} + \frac{uv e^{-4t}}{2} \right) \partial t$$

$$X_{16} = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{u^2 e^{-2t}}{2} - \frac{uv}{2} - \frac{v^2 e^{-2t}}{2} + \frac{u^2 e^{-4t}}{4} + \frac{v^2 e^{-4t}}{4} + \frac{uv e^{-4t}}{2} \right) \partial t$$

$$X_{17} = \left(-\frac{e^{2t}}{4} + \frac{e^{-2t}}{4} \right) \partial t + \left(\frac{u}{2} + \frac{u e^{-2t}}{2} + \frac{v e^{-2t}}{2} - \frac{v e^{2t}}{2} \right) \partial u + \left(\frac{v}{2} - \frac{v e^{2t}}{2} \right) \partial v$$

$$X_{18} = \left(-\frac{1}{2} + \frac{e^{-2t}}{4} + \frac{e^{2t}}{4} \right) \partial t + \left(-\frac{u}{2} + \frac{u e^{-2t}}{2} + \frac{v e^{-2t}}{2} + \frac{v e^{2t}}{2} \right) \partial u + \left(-\frac{v}{2} + \frac{v e^{2t}}{2} \right) \partial v$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$
$$\mathrm{f}_2$$
$$\mathrm{f}_3$$

WARNING:

Some of the calculated generators did not satisfy the linearised symmetry conditions. Thus, the presented list here is not complete and consists exclusively of the calculated generators that satisfy the linearised symmetry conditions.

The execution time of the script was:

0 hours 1 minutes 59 seconds.

Run 03_41PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}u}{\mathrm{d}t} = u + v,$$
$$\frac{\mathrm{d}v}{\mathrm{d}t} = u + v.$$

The calculated generators are:

$$X_1 = \left(-\frac{5v}{8} + \frac{3u}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_2 = \left(\frac{u}{8} + \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{v^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2} \right) \partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_3 = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{u^2e^{-2t}}{2} - \frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial t$$

$$X_4 = \left(\frac{v}{2} - \frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} \right) \partial t$$

$$X_5 = \left(-\frac{3u}{8} + \frac{5v}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{u^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2} \right) \partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_6 = (1)\, \partial t,$$

$$X_7 = \left(-\frac{u^2}{4} - \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial t$$

$$X_8 = \left(-\frac{u}{8} - \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{ve^{-4t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_9 = \left(-\frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ve^{2t}}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2}\right)\partial u + \left(\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{10} = \left(\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial u + \left(-\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial v$$

$$X_{11} = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{v^2e^{-2t}}{2} - \frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial t$$

$$X_{12} = \left(-\frac{1}{2} + \frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} + \frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{13} = \left(-\frac{1}{2} - \frac{e^{-2t}}{4} - \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2} + -\frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} - \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{14} = \left(-\frac{u}{8} + \frac{3v}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{2t}}{8} + \frac{ve^{-4t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} - \frac{v^2e^{2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{15} = \left(-\frac{3v}{8} + \frac{u}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-4t}}{8} + -\frac{ve^{-2t}}{8} + \frac{ue^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} - \frac{uv}{2} - \frac{v^2e^{2t}}{2} + -\frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{16} = \left(\frac{u}{2} - \frac{v}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} \right) \partial t$$

$$X_{17} = \left(-\frac{e^{2t}}{4} + \frac{e^{-2t}}{4} \right) \partial t + \left(\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} - \frac{ve^{2t}}{2} \right) \partial u + \left(\frac{v}{2} - \frac{ve^{2t}}{2} \right) \partial v$$

$$X_{18} = \left(-\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial u + \left(\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial v$$

$$X_{19} = \left(u\,\mathrm{f}_2(t) + v\,\mathrm{f}_1(t) - v\,\mathrm{f}_2(t) + \frac{u\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{8} + \frac{u\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{8} + \frac{v\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{8} \right.$$
$$+ \frac{v\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{8} - \frac{3ve^{-2t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{8} - \frac{3ve^{-2t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{8} - \frac{ue^{-4t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{8} - \frac{ue^{2t}\int_0^t \mathrm{f}_1(s)e^{-2}}{8}$$
$$+ -\frac{ue^{2t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{8} - \frac{ve^{-4t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{8} - \frac{ve^{-4t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{8} + \frac{ue^{-2t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{8} + \frac{ue^{-2t}\int_0^t \left(-\mathrm{f}_1\right.}{8}$$
$$\left. + \frac{3ve^{2t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{8} + \mathrm{f}_3(t) \right) \partial t + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t)\right.$$
$$+ -v^2\,\mathrm{f}_2(t) - \frac{u^2\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{4} - \frac{u^2\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{4} + \frac{v^2\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{4} + \frac{v^2\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{4} + uv\,\mathrm{f}_1(t)$$
$$+ \frac{uv\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{2} + \frac{uv\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{2} + \frac{u^2e^{-2t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{2} + \frac{u^2e^{-2t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{2} + \frac{v^2e^{2t}\int_0^t \mathrm{f}_1(s)e^{-2s}}{2}$$
$$+ -\frac{v^2e^{-2t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{2} - \frac{v^2e^{-2t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{2} - \frac{u^2e^{-4t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{4} - \frac{u^2e^{-4t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{4} - \frac{v^2e^{-4t}}{}$$
$$\left. + -\frac{uve^{-4t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{2} - \frac{uve^{-4t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{2} \right) \partial u + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t)\right.$$
$$\left. + \frac{v^2\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{2} + \frac{v^2\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{2} - v^2\,\mathrm{f}_2(t) + uv\,\mathrm{f}_1(t) + \frac{v^2e^{2t}\int_0^t \mathrm{f}_1(s)e^{-2s}\,ds}{2} + \frac{v^2e^{2t}\int_0^t \left(-\mathrm{f}_1(s)e^{-2s}\right)\,ds}{2} \right) \partial$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$
$$\mathrm{f}_2$$
$$\mathrm{f}_3$$

The execution time of the script was:

0 hours 1 minutes 7 seconds.

Run 03_55PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}u}{\mathrm{d}t} = u + v,$$
$$\frac{\mathrm{d}v}{\mathrm{d}t} = u + v.$$

The calculated generators are:

$$X_1 = \left(-\frac{5v}{8} + \frac{3u}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_2 = \left(\frac{v}{2} - \frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2}\right)\partial t$$

$$X_3 = \left(-\frac{u}{8} + \frac{3v}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{2t}}{8} + \frac{ve^{-4t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} - \frac{v^2e^{2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_4 = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{v^2e^{-2t}}{2} - \frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial t$$

$$X_5 = \left(-\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial u + \left(\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial v$$

$$X_6 = (1)\,\partial t,$$

$$X_7 = \left(-\frac{1}{2} - \frac{e^{-2t}}{4} - \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2} + -\frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} - \frac{ve^{2t}}{2}\right)\partial v$$

$$X_8 = \left(-\frac{3v}{8} + \frac{u}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-4t}}{8} + -\frac{ve^{-2t}}{8} + \frac{ue^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} - \frac{uv}{2} - \frac{v^2e^{2t}}{2} + -\frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_9 = \left(-\frac{3u}{8} + \frac{5v}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{u^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{10} = \left(-\frac{u^2}{4} - \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial t$$

$$X_{11} = \left(-\frac{u}{8} - \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{ve^{-4t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{12} = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{u^2e^{-2t}}{2} - \frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial t$$

$$X_{13} = \left(\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial u + \left(-\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial v$$

$$X_{14} = \left(-\frac{1}{2} + \frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} + \frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{15} = \left(-\frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ve^{2t}}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2}\right)\partial u + \left(\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{16} = \left(\frac{u}{8} + \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{v^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{17} = \left(-\frac{e^{2t}}{4} + \frac{e^{-2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} - \frac{ve^{2t}}{2}\right)\partial u + \left(\frac{v}{2} - \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{18} = \left(\frac{u}{2} - \frac{v}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2}\right)\partial t$$

$$X_{19} = \left(u\,\mathrm{f}_2(t) + v\,\mathrm{f}_1(t) - v\,\mathrm{f}_2(t) + \mathrm{f}_3(t)\right)\partial t + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t) - v^2\,\mathrm{f}_2(t) + uv\,\mathrm{f}_1(t)\right)\partial u + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t) - v^2\,\mathrm{f}_2(t) + uv\,\mathrm{f}_1(t)\right)\partial v$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$
$$\mathrm{f}_2$$
$$\mathrm{f}_3$$

The execution time of the script was:

0 hours 1 minutes 9 seconds.

Run 04_00PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}u}{\mathrm{d}t} = u + v,$$
$$\frac{\mathrm{d}v}{\mathrm{d}t} = u + v.$$

The calculated generators are:

$$X_1 = \left(-\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial u + \left(\frac{1}{2} + \frac{e^{2t}}{2}\right)\partial v$$

$$X_2 = \left(-\frac{5v}{8} + \frac{3u}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_3 = \left(\frac{u}{2} - \frac{v}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2}\right)\partial t$$

$$X_4 = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{v^2e^{-2t}}{2} - \frac{uv}{2} - \frac{u^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial t$$

$$X_5 = \left(-\frac{u^2}{4} - \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial t$$

$$X_6 = \left(-\frac{1}{2} + \frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} + \frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_7 = \left(-\frac{3v}{8} + \frac{u}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-4t}}{8} + -\frac{ve^{-2t}}{8} + \frac{ue^{2t}}{8}\right)\partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} - \frac{uv}{2} - \frac{v^2e^{2t}}{2} + -\frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\right)\partial u + \left(-\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_8 = \left(\frac{u^2}{4} + \frac{v^2}{4} + \frac{u^2e^{-2t}}{2} - \frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial t$$

$$X_9 = (1)\,\partial t,$$

$$X_{10} = \left(-\frac{e^{-2t}}{4} + \frac{e^{2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ve^{2t}}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2}\right)\partial u + \left(\frac{v}{2} + \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{11} = \left(-\frac{u}{8} + \frac{3v}{8} - \frac{3ve^{2t}}{8} - \frac{ue^{-2t}}{8} - \frac{ve^{-2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{2t}}{8} + \frac{ve^{-4t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} - \frac{v^2e^{2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} - \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{12} = \left(\frac{u}{8} + \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{3ve^{2t}}{8}\right)\partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{v^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2}\right)\partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2}\right)\partial v$$

$$X_{13} = \left(\frac{v}{2} - \frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2}\right)\partial t$$

$$X_{14} = \left(-\frac{1}{2} - \frac{e^{-2t}}{4} - \frac{e^{2t}}{4}\right)\partial t + \left(-\frac{u}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{-2t}}{2} + -\frac{ve^{2t}}{2}\right)\partial u + \left(-\frac{v}{2} - \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{15} = \left(-\frac{e^{2t}}{4} + \frac{e^{-2t}}{4}\right)\partial t + \left(\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{-2t}}{2} - \frac{ve^{2t}}{2}\right)\partial u + \left(\frac{v}{2} - \frac{ve^{2t}}{2}\right)\partial v$$

$$X_{16} = \left(-\frac{u}{8} - \frac{v}{8} - \frac{3ve^{-2t}}{8} - \frac{ue^{2t}}{8} + \frac{ue^{-4t}}{8} + \frac{ue^{-2t}}{8} + \frac{ve^{-4t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{v^2}{4} + \frac{u^2}{4} + \frac{u^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} + -\frac{uv}{2} - \frac{v^2e^{-2t}}{2} + \frac{u^2e^{-4t}}{4} + \frac{v^2e^{-4t}}{4} + \frac{uve^{-4t}}{2} \right) \partial u + \left(-\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_{17} = \left(-\frac{3u}{8} + \frac{5v}{8} - \frac{3ue^{-2t}}{8} - \frac{ue^{-4t}}{8} - \frac{ue^{2t}}{8} - \frac{ve^{-4t}}{8} + \frac{ve^{-2t}}{8} + \frac{3ve^{2t}}{8} \right) \partial t + \left(-\frac{u^2}{4} + \frac{v^2}{4} + \frac{uv}{2} + \frac{v^2e^{-2t}}{2} + \frac{v^2e^{2t}}{2} - \frac{u^2e^{-2t}}{2} - \frac{u^2e^{-4t}}{4} - \frac{v^2e^{-4t}}{4} - \frac{uve^{-4t}}{2} \right) \partial u + \left(\frac{v^2}{2} + \frac{v^2e^{2t}}{2} \right) \partial v$$

$$X_{18} = \left(\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial u + \left(-\frac{1}{2} + \frac{e^{2t}}{2} \right) \partial v$$

$$X_{19} = \left(u\,\mathrm{f}_2(t) + v\,\mathrm{f}_1(t) - v\,\mathrm{f}_2(t) + \mathrm{f}_3(t) \right) \partial t + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t) - v^2\,\mathrm{f}_2(t) + uv\,\mathrm{f}_1(t) \right) \partial u + \left(u\,\mathrm{f}_3(t) + v\,\mathrm{f}_3(t) + u^2\,\mathrm{f}_2(t) + v^2\,\mathrm{f}_1(t) - v^2\,\mathrm{f}_2(t) + uv\,\mathrm{f}_1(t) \right) \partial v$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$
$$\mathrm{f}_2$$
$$\mathrm{f}_3$$

The execution time of the script was:

0 hours 1 minutes 10 seconds.

Chapter 3

hydons_model

Run 02_42PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}y_1}{\mathrm{d}t} = \frac{ty_1 + y_2^2}{-t^2 + y_1 y_2},$$
$$\frac{\mathrm{d}y_2}{\mathrm{d}t} = \frac{ty_2 + y_1^2}{-t^2 + y_1 y_2}.$$

The calculated generators are:

$$X_1 = (t)\,\partial t + (y_1)\,\partial y_1 + (y_2)\,\partial y_2,$$

$$X_2 = \left(-t^2\,\mathrm{f}_1(t) + y_1 y_2\,\mathrm{f}_1(t)\right)\partial t + \left(y_2^2\,\mathrm{f}_1(t) + ty_1\,\mathrm{f}_1(t)\right)\partial y_1 + \left(y_1^2\,\mathrm{f}_1(t) + ty_2\,\mathrm{f}_1(t)\right)\partial y_2$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

WARNING:

Some of the calculated generators did not satisfy the linearised symmetry conditions. Thus, the presented list here is not complete and consists exclusively of the calculated generators that satisfy the linearised symmetry conditions.

The execution time of the script was:

0 hours 0 minutes 18 seconds.

Run 02_55PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}y_1}{\mathrm{d}t} = \frac{ty_1 + y_2^2}{-t^2 + y_1 y_2},$$
$$\frac{\mathrm{d}y_2}{\mathrm{d}t} = \frac{ty_2 + y_1^2}{-t^2 + y_1 y_2}.$$

The calculated generators are:

$$X_1 = (t)\,\partial t + (y_1)\,\partial y_1 + (y_2)\,\partial y_2,$$

$$X_2 = \left(-t^2\,\mathrm{f}_1(t) + y_1 y_2\,\mathrm{f}_1(t)\right)\partial t + \left(y_2^2\,\mathrm{f}_1(t) + t y_1\,\mathrm{f}_1(t)\right)\partial y_1 + \left(y_1^2\,\mathrm{f}_1(t) + t y_2\,\mathrm{f}_1(t)\right)\partial y_2$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

The execution time of the script was:

0 hours 0 minutes 18 seconds.

Run 02_59PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}y_1}{\mathrm{d}t} = \frac{ty_1 + y_2^2}{-t^2 + y_1 y_2},$$
$$\frac{\mathrm{d}y_2}{\mathrm{d}t} = \frac{ty_2 + y_1^2}{-t^2 + y_1 y_2}.$$

The calculated generators are:

$$X_1 = (t)\,\partial t + (y_1)\,\partial y_1 + (y_2)\,\partial y_2,$$

$$X_2 = \left(-t^2\,\mathrm{f}_1(t) + y_1 y_2\,\mathrm{f}_1(t)\right)\partial t + \left(y_2^2\,\mathrm{f}_1(t) + t y_1\,\mathrm{f}_1(t)\right)\partial y_1 + \left(y_1^2\,\mathrm{f}_1(t) + t y_2\,\mathrm{f}_1(t)\right)\partial y_2$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

The execution time of the script was:

0 hours 0 minutes 18 seconds.

Run 04_05PM_26_October-2021

Degree in tangential ansätze: 2.
The system of ODEs is given by:

$$\frac{\mathrm{d}y_1}{\mathrm{d}t} = \frac{ty_1 + y_2^2}{-t^2 + y_1 y_2},$$
$$\frac{\mathrm{d}y_2}{\mathrm{d}t} = \frac{ty_2 + y_1^2}{-t^2 + y_1 y_2}.$$

The calculated generators are:

$$X_1 = (t)\,\partial t + (y_1)\,\partial y_1 + (y_2)\,\partial y_2,$$

$$X_2 = \left(-t^2\,\mathrm{f}_1(t) + y_1 y_2\,\mathrm{f}_1(t)\right)\partial t + \left(y_2^2\,\mathrm{f}_1(t) + t y_1\,\mathrm{f}_1(t)\right)\partial y_1 + \left(y_1^2\,\mathrm{f}_1(t) + t y_2\,\mathrm{f}_1(t)\right)\partial y_2$$

Some of the generators might contain the following arbitrary functions:

$$\mathrm{f}_1$$

The execution time of the script was:

0 hours 0 minutes 18 seconds.