

# Summary of symmetry calculations

October 12, 2021



# Contents

1	DBH_model	5
2	linear_model	7
3	hydons_model	9



# Chapter 1

## DBH\_model

Run 03\_15PM\_12\_October-2021

Degree in tangential ansätze: 1

The system of ODEs is given by:

$$\begin{aligned}\frac{dw_1}{dt} &= -w_1w_2 - w_1w_3 + w_2w_3, \\ \frac{dw_2}{dt} &= -w_1w_2 + w_1w_3 - w_2w_3, \\ \frac{dw_3}{dt} &= w_1w_2 - w_1w_3 - w_2w_3.\end{aligned}$$

The calculated generators are:

$$\begin{aligned}X_1 &= (1) \partial t, \\ , \\ X_2 &= (t^2) \partial t + (-2tw_1 + 1) \partial w_1 + (-2tw_2 + 1) \partial w_2 + (-2tw_3 + 1) \partial w_3, \\ , \\ X_3 &= (-t) \partial t + (w_1) \partial w_1 + (w_2) \partial w_2 + (w_3) \partial w_3.\end{aligned}$$



## Chapter 2

# linear\_model

Run 03\_14PM\_12\_October-2021

**Degree in tangential ansätze:** 1

The system of ODEs is given by:

$$\begin{aligned}\frac{du}{dt} &= u + v, \\ \frac{dv}{dt} &= u + v.\end{aligned}$$

The calculated generators are:

$$\begin{aligned}
X_1 &= \left( \frac{e^{2t}}{4} - \frac{1}{2} + \frac{e^{-2t}}{4} \right) \partial t + \left( -\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{ve^{2t}}{2} + \frac{ve^{-2t}}{2} \right) \partial u + \left( \frac{ve^{2t}}{2} - \frac{v}{2} \right) \partial v, \\
&, \\
X_2 &= \left( \frac{e^{2t}}{4} - \frac{e^{-2t}}{4} \right) \partial t + \left( \frac{u}{2} - \frac{ue^{-2t}}{2} + \frac{ve^{2t}}{2} - \frac{ve^{-2t}}{2} \right) \partial u + \left( \frac{ve^{2t}}{2} + \frac{v}{2} \right) \partial v, \\
&, \\
X_3 &= \left( \frac{e^{2t}}{2} + \frac{1}{2} \right) \partial u + \left( \frac{e^{2t}}{2} - \frac{1}{2} \right) \partial v, \\
&, \\
X_4 &= \left( \frac{u}{2} + \frac{ue^{-2t}}{2} - \frac{v}{2} + \frac{ve^{-2t}}{2} \right) \partial t, \\
&, \\
X_5 &= \left( -\frac{e^{2t}}{4} - \frac{1}{2} - \frac{e^{-2t}}{4} \right) \partial t + \left( -\frac{u}{2} - \frac{ue^{-2t}}{2} - \frac{ve^{2t}}{2} - \frac{ve^{-2t}}{2} \right) \partial u + \left( -\frac{ve^{2t}}{2} - \frac{v}{2} \right) \partial v, \\
&, \\
X_6 &= \left( -\frac{u}{2} + \frac{ue^{-2t}}{2} + \frac{v}{2} + \frac{ve^{-2t}}{2} \right) \partial t, \\
&, \\
X_7 &= \left( \frac{e^{2t}}{2} - \frac{1}{2} \right) \partial u + \left( \frac{e^{2t}}{2} + \frac{1}{2} \right) \partial v, \\
&, \\
X_8 &= (1) \partial t, \\
&, \\
X_9 &= \left( -\frac{e^{2t}}{4} + \frac{e^{-2t}}{4} \right) \partial t + \left( \frac{u}{2} + \frac{ue^{-2t}}{2} - \frac{ve^{2t}}{2} + \frac{ve^{-2t}}{2} \right) \partial u + \left( -\frac{ve^{2t}}{2} + \frac{v}{2} \right) \partial v, \\
&, \\
X_{10} &= (f_1(t)) \partial t + ((u+v)f_1(t)) \partial u + ((u+v)f_1(t)) \partial v.
\end{aligned}$$

Some of the generators might contain the following arbitrary functions:

$$f_1$$



## Chapter 3

# hydons\_model

**Run 03\_14PM\_12\_October-2021**

**Degree in tangential ansätze: 1**

The system of ODEs is given by:

$$\begin{aligned}\frac{dy_1}{dt} &= \frac{ty_1 + y_2^2}{-t^2 + y_1y_2}, \\ \frac{dy_2}{dt} &= \frac{ty_2 + y_1^2}{-t^2 + y_1y_2}.\end{aligned}$$

The calculated generators are:

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

**Run 03\_16PM\_12\_October-2021**

**Degree in tangential ansätze: 2**

The system of ODEs is given by:

$$\begin{aligned}\frac{dy_1}{dt} &= \frac{ty_1 + y_2^2}{-t^2 + y_1y_2}, \\ \frac{dy_2}{dt} &= \frac{ty_2 + y_1^2}{-t^2 + y_1y_2}.\end{aligned}$$

The calculated generators are:

Some of the found generators did not satisfy the linearised symmetry conditions. The presented list here is not complete and consists of the generators that were found by the script.

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

Some of the generators might contain the following arbitrary functions:

$$f_1$$

## Run 03\_27PM\_12\_October-2021

**Degree in tangential ansätze: 2**

The system of ODEs is given by:

$$\begin{aligned} \frac{dy_1}{dt} &= \frac{ty_1 + y_2^2}{-t^2 + y_1 y_2}, \\ \frac{dy_2}{dt} &= \frac{ty_2 + y_1^2}{-t^2 + y_1 y_2}. \end{aligned}$$

The calculated generators are:

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

Some of the generators might contain the following arbitrary functions:

$$f_1$$

Some of the found generators did not satisfy the linearised symmetry conditions. The presented list here is not complete and consists of the generators that were found by the script.

## Run 03\_31PM\_12\_October-2021

**Degree in tangential ansätze: 2**

The system of ODEs is given by:

$$\begin{aligned} \frac{dy_1}{dt} &= \frac{ty_1 + y_2^2}{-t^2 + y_1 y_2}, \\ \frac{dy_2}{dt} &= \frac{ty_2 + y_1^2}{-t^2 + y_1 y_2}. \end{aligned}$$

The calculated generators are:

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

Some of the generators might contain the following arbitrary functions:

$$f_1$$

Some of the found generators did not satisfy the linearised symmetry conditions. The presented list here is not complete and consists of the generators that were found by the script.

## Run 08\_16PM\_12\_October-2021

**Degree in tangential ansätze: 2**

The system of ODEs is given by:

$$\begin{aligned} \frac{dy_1}{dt} &= \frac{ty_1 + y_2^2}{-t^2 + y_1y_2}, \\ \frac{dy_2}{dt} &= \frac{ty_2 + y_1^2}{-t^2 + y_1y_2}. \end{aligned}$$

The calculated generators are:

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

Some of the generators might contain the following arbitrary functions:

$$f_1$$

Some of the found generators did not satisfy the linearised symmetry conditions. The presented list here is not complete and consists of the generators that were found by the script.

## Run 08\_24PM\_12\_October-2021

**Degree in tangential ansätze: 2**

The system of ODEs is given by:

$$\begin{aligned}\frac{dy_1}{dt} &= \frac{ty_1 + y_2^2}{-t^2 + y_1y_2}, \\ \frac{dy_2}{dt} &= \frac{ty_2 + y_1^2}{-t^2 + y_1y_2}.\end{aligned}$$

The calculated generators are:

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

Some of the generators might contain the following arbitrary functions:

$$f_1$$

Some of the found generators did not satisfy the linearised symmetry conditions. The presented list here is not complete and consists of the generators that were found by the script.