The complete eigenwert-solution of damped spacetime-oscillations for two coupled tangential spacetimes with ftl-states

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Abstract:

The complete eigenwert-problem of damping process of oscillating tangential spacetime is described and solved. Characterized are all solutions of an associated spacetime - differential-equation of second order from advanced Lorentz-Einstein-factor, which defines the whole oscillation-process of damping states. This system of oscillation-solutions can be described as a set of energy-equations. The system of two coupled spacetimes to a linked shell-model allows movement of material bodies or particles with ftl and real restmasses. This spacetime- lineelement can be interpreted as a one-parametrized pseudo-Kummersurface.

Key-words:
Damped space-time-oscillation; eigenwerte; Planck-energy; tangential spacetime; differential-equation of second order; advanced Lorentz-Einstein-factor; ftl; super-luminar-velocity (sulv); two coupled spacetimes; linked shell-model.

1. Introduction:

According to the principle of damped oscillation, a linear differential equation (DE) of second order can be set up for case of spacetime-damping whose solutions contains an extended Lorentz-Einstein factor (LE factor) as the amplitude, which leads by analogy to sulv or ftl for real rest masses.

The normal LE factor appears in it as a special case for the DE of undamped oscillation and in all formulas in the Appendices A and B all e-functions including imaginary values can be solved via Euler-equation and can be quantized after their sin-and cos-eigenstates. [1.] A new paradigm shows that the classical LG c only occurs as the natural oscillation speed of the local space-time. [2.] The analogy is not only that of the damped oscillation, but the Einstein- and Feinberg-models for particles with sub-light speed and classical tachyons can also be combined in a similar way, as Planck did with the various models and equations of Wien and Rayleigh in the blackbody radiation model.

Negative kinetic energies do occur because the total energy approaches zero - but this happens with every damped oscillation that from a certain point the quantities become negative if, depending on the standardization of the quantities, the current oscillation amplitude is subtracted from the rest amplitude without applying a cut-off at the corresponding point where the difference is zero. Therefore, there is no spontaneous charge reversal according to the classical Dirac equation, because the total energy is still positive and approaches zero as v approaches infinity. The Dirac equation would also have to be expanded according to this model, which has not yet happened to be done. In this respect, the prediction should be viewed with caution. The rest energy would no longer be constant, however, depending on the oscillation parameter. It is important that the rest mass remains real. The Lorentz space of the classical special theory of relativity is embedded in a Euclidean space of fourth order, which opens automatically through the damping process [3.],[4.]. Experimental proof is difficult because the effects would be small and although resting, rotating or oscillating bodies can be used instead of fast-moving ones, the oscillation would have to be replaced by rotation. At 10.000 revolutions per second and a ton of rest mass, a measurement could be achieved within the scope of today's measurement accuracy if all other secondary effects that can occur when large masses rotate, e.g. rotational imbalances or eddy currents, could be calculated out. Of course, an electrically neutral body would also have to be used. It may also be possible to provide evidence by measuring the Lense-Thirring effect, where space-time itself rotates locally, but the rotation speed is probably too low here. Mathematically speaking, this space-time is a so-called one-parameter pseudo-Kummer surface, a special case of Finsler spaces, where the parameter is the damping factor. All possible solutions for damping-process of local tangential spacetime from its eigenwertequation are hereinafter described.

2. Methods/calculations:

2.1. Solution-Conditions:

Searched are all solutions for the linear, homogeneous differential equation of second order of the form:

$$\ddot{\Psi}+2\cdot\mu\cdot\dot{\Psi}+\omega^2\cdot\Psi=0 \qquad (1.1)$$

with damping factor: $2\cdot\mu=\frac{W_d}{\hbar}$ (1.2)

and $\omega^2=\frac{\omega^2{}_{PL}\cdot\left(1-e^{\frac{i\cdot W_d}{\hbar}\cdot t}\right)}{A}$ (1.3)

where W_d spacetime damping energy and:

$$A=\frac{1}{\sqrt{\left(1-\frac{v^2}{c^2}\right)^2+\frac{n\cdot a^2\cdot v^2}{c^4}}} \qquad (1.4)$$

Limiting conditions are:

$$\Psi(0)=\alpha;\dot{\Psi}(0)=\beta;\ \omega,\mu\in\mathbb{R}^+.$$

The variables μ,ω may be constants or time dependent functions. Therefore this description leads to the characteristical eigenwert- polynom of:

$$P_A(\lambda)=\lambda^2+2\cdot\mu\cdot\lambda+\omega^2 \tag{2.1}$$

which means:

$$P_A(\lambda)=\lambda^2+\frac{W_d}{\hbar}\cdot\lambda+\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A} \tag{2.2}$$

with its eigenwert-zeros of:

$$\Rightarrow \lambda_{1,2}=-\mu\pm\sqrt{\mu^2-\omega^2} \tag{2.3}$$

which means:

$$\lambda_{1,2}=-\frac{W_d}{2\cdot\hbar}\pm\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}} \tag{2.4}$$

This leads after some conversions to matrix $\boldsymbol{B}$:

$$\boldsymbol{B}=\begin{pmatrix} 0 & 1 \\ -\omega^2 & -2\cdot\mu \end{pmatrix} \tag{2.5}$$

This $2x2$ matrix $\boldsymbol{B}$ contains:

$$\boldsymbol{B}=\begin{pmatrix} 0 & 0 \\ -\frac{\omega^2{}_{PL}\cdot\left(1-e^{\frac{i\cdot W_d}{\hbar}\cdot t}\right)}{A} & \frac{-W_d}{\hbar} \end{pmatrix} \tag{2.6}$$

The discriminant $D=(\mu^2-\omega^2)$ of eigenwert-zero equation is now decisive for the type of space-time-movement, which is caused.

This discriminant means:

$$D=\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A} \tag{3.1}$$

There are three cases of existence:

1. Weak damping: $0\leq\mu<\omega\Leftrightarrow\omega^2-\mu^2>0$ (3.2)
2.Aperiodic limit case: $\mu=\omega\Leftrightarrow\mu^2-\omega^2=0$ (3.3)
2.Strong damping: $\mu>\omega\Leftrightarrow\mu^2-\omega^2>0$ (3.4)

This leads to following solution-conditions:

1. In case of $\mu<\omega,$ matrix $\boldsymbol{B}$ is $\boldsymbol{B}\in M(2x2,\mathbb{C})$ and complex diagonizable but with solutions in $\mathbb{R}$.

2. The case of $\mu=\omega$ shows, that matrix $\boldsymbol{B}$ is triagonizable in aperiodic limit case.

3. In case of $\mu>\omega,$ the matrix $\boldsymbol{B}$ is diagonizable in $\mathbb{R}$.

2.2 Solutions of DE:

1. For $\mu^2-\omega^2<0 \Leftrightarrow \omega^2-\mu^2>0$ the eigenvalues are complex of the form:

$$\lambda_1=-\mu+i\cdot\sqrt{\omega^2-\mu^2}$$
$$\lambda_2=-\mu-i\sqrt{\omega^2-\mu^2} \qquad (4.1)$$

This leads to general reell solution in this case of:

$$\Psi_0(t)=\mathrm{e}^{-\mu\cdot t}\cdot\left[\alpha_1\cdot\begin{pmatrix}\cos(\gamma\cdot t)\\ -\mu\cdot\cos(\gamma\cdot t)-\gamma\cdot\sin(\gamma\cdot t)\end{pmatrix}+\alpha_2\cdot\begin{pmatrix}\sin(\gamma\cdot t)\\ \gamma\cdot\cos(\gamma\cdot t)-\mu\cdot\sin(\gamma\cdot t)\end{pmatrix}\right] \qquad (4.2)$$

(Detailed solution for this first case of weak damping see Appendix A.)

The limiting conditions are:

$$\Psi_0(0)=\alpha \ \wedge \ \dot{\Psi}_0(0)=\beta \qquad (4.3)$$

This leads to final limiting conditions in the first eigenwert- solution of:

$$\alpha_1=\alpha \ \wedge \ \alpha_2=\frac{\beta+\mu\cdot\alpha}{\gamma};\gamma:=\sqrt{\omega^2-\mu^2}=\sqrt{D} \quad . \qquad (4.4)$$

2. For $\mu=\omega$ there is the characteristic polynom $P_A(\lambda)$:

$$P_A(\lambda)=(\lambda+\mu)^2\Rightarrow A\,is\ trigonalizable \quad . \qquad (5.1)$$

There exists one eigenvector $\vec{v}=\begin{pmatrix}1\\-\mu\end{pmatrix}$ to one eigenwert of:

$$\lambda=-\mu=-\frac{W_d}{2\cdot\hbar} \qquad (5.2)$$

This leads to the general solution-conditions of:

$$\Psi(t)=\alpha\cdot\mathrm{e}^{-\mu\cdot t}+(\beta+\alpha\cdot\mu)\cdot t\cdot\mathrm{e}^{-\mu\cdot t} \tag{5.3}$$

with its limiting-conditions of:

$$\Psi(0)=\alpha \;\wedge\; \dot{\Psi}(0)=\beta \tag{5.4}$$

which means:

$$\Psi(t)=\Psi(0)\cdot\mathrm{e}^{\frac{-W_d}{2\cdot\hbar}\cdot t}+\left(\dot{\Psi}(0)+\Psi(0)\cdot\frac{W_d}{2\cdot\hbar}\right)\cdot t\cdot\mathrm{e}^{-\frac{W_d}{2\cdot\hbar}} \tag{5.5}$$

3. For $\omega<\mu$ the eigenvalues of the characteristic polynom:

$$P_A(\lambda)=\lambda^2+2\cdot\mu\cdot\lambda+\omega^2 \tag{2.1}$$

are

$$\lambda_1=-\mu+\sqrt{\mu^2-\omega^2} \quad \text{and} \quad \lambda_2=-\mu-\sqrt{\mu^2-\omega^2} \tag{2.2}$$

with (theorem of Vièta) limiting conditions of:

$$\lambda_1\cdot\lambda_2=\omega^2 \;\wedge\; \lambda_1+\lambda_2=-2\cdot\mu \quad . \tag{6.1}$$

The general solution of the DE

$$\ddot{\Psi}+2\cdot\mu\cdot\dot{\Psi}+\omega^2\Psi=0 \tag{1.1}$$

is now:

$$\Psi_0(t)=\alpha_1\cdot\mathrm{e}^{\lambda_1\cdot t}+\alpha_2\cdot\mathrm{e}^{\lambda_2\cdot t} \tag{6.2}$$

with its boundary conditions of:

$$\alpha_1=\frac{\beta-\lambda_2\cdot\alpha}{\lambda_1-\lambda_2} \tag{6.3}$$

and

$$\alpha_2=\frac{\beta-\lambda_1\cdot\alpha}{\lambda_2-\lambda_1} \quad . \tag{6.4}$$

which leads to the solution-equation of:

$$\Psi_0(t)=\frac{\dot{\Psi}_0(0)-\left(-\mu-\sqrt{\mu^2-\omega^2}\right)\cdot\Psi_0(0)}{2\cdot\sqrt{\mu^2-\omega^2}}\cdot e^{\left(-\mu+\sqrt{\mu^2-\omega^2}\right)\cdot t}$$

$$+\frac{\dot{\Psi}_0(0)-\left(-\mu+\sqrt{\mu^2-\omega^2}\right)\cdot\Psi_0(0)}{-2\cdot\sqrt{\mu^2-\omega^2}}\cdot e^{\left(-\mu-\sqrt{\mu^2-\omega^2}\right)\cdot t} \tag{6.5}$$

for the case of strong damping of the two coupled tangential spacetimes. (The complete solution for this third case of strong damping can be seen in Appendix B.)

For all three cases the damping-energies W_d are [8.]:

$$W_{d,1}=\hbar\cdot\omega\cdot(4\cdot n+1)\cdot\frac{\pi}{2}=\frac{\hbar\cdot v}{r_{PL}}-\frac{W^2{}_{PL}\cdot r_{PL}}{\hbar\cdot v}\cdot\left(1+\frac{1}{A}\right);n\in\mathbb{Z}$$
$$W_{d,2}=\hbar\cdot\omega\cdot(4\cdot n-1)\cdot\frac{\pi}{2}=\frac{\hbar\cdot v}{r_{PL}}-\frac{W^2{}_{PL}\cdot r_{PL}}{\hbar\cdot v}\cdot\left(1-\frac{1}{A}\right);n\in\mathbb{Z} \tag{6.6}$$

where ω is damping frequency.

This two terms can be concentrated in one:

$$W_{d_{1,2}}=\hbar\cdot\omega\cdot(2\cdot n+1)=\frac{\hbar\cdot v}{r_{PL}}-\frac{W^2{}_{PL}\cdot r_{PL}}{\hbar\cdot v}\cdot\left(1\pm\frac{1}{A}\right);$$
$$n\in(2\cdot m)\ for\ \left(1+\frac{1}{A}\right)\vee n\in(2\cdot m+1)\ for\ \left(1-\frac{1}{A}\right);m\in\mathbb{Z} \tag{6.7}$$

3. Summary:

The complete eigenwertproblem of analogon of damped local spacetime-oscillation is solvable and solved. This system leads in its description to velocity-values, which can be interpreted as superluminar possible, because the classical local ruling invariance-velocity c of SRT here appears only as a resonance velocity of space-time associated with its Planck eigenfrequency and light-barrier for undamped spacetime states. In description of analogy of damped states, this velocity no longer is a maximal speed because this characteristic only appears in the system of undamped state, which can be identified with description of classical SRT and classical Lorentz-Einsten-factor. As a result the consequence is a real restmass even for acceleration to ftl [5.]. In this case there appear no imaginary restmasses like in classical tachyon-description after Feinberg [6.]. But the restmass is no longer a constant [7.] , its value depends of a damping-factor a , which is caused through oscillation or rotation. In fact restmass increases with this factor increasing.
The constraint for this damping factor is [8.]:

$$a\neq\sqrt{\frac{2}{n}}\cdot c\,;n\in\mathbb{N} \tag{7.1}$$

which is derived from a Taylor-series development, seen in former papers [3.],[4.] and leads to restmass-term for damped spacetime-systems of:

$$E_0=\frac{2\cdot m_0\cdot c^4}{2\cdot c^2-n\cdot a^2} \tag{7.2}$$

which limites for the damping-term of $a \equiv 0$ and goes over then in classical SRT-energy-term of:

$$E_0 = m_0 \cdot c^2 \tag{7.3}$$

4. Conclusion:

All eigenwerte and eigenfunctions of a coupled local tangential spacetime-lineelement of fourth order can be formulated, while the related differential-equation is solved. This results leads to a possible form of superluminar velocities, where the cause of this phenomenon is the coupling of tardyon- and tachyon states, both described in SRT over the two spacetime-states. (No nuts; ftl in a nut-shell!) Local invariance velocity only can be interpreted as eigen- vibrating velocity of local spacetime with its related eigenfrequency of Planck-form. Some of them can be described over Lambert-function [10.],[11.] but Euler-equation is possible in this case, too [8.].

5. Discussion:

Kinetic energy appears to have a possibility to be negative after some damping time. But this is no new physics and doesn‘t cause any problems, even not in Dirac-equation because every description of a damped, oscillating system can be described over its energy-conditions and appears to have negative kinetic energies after the value of whole energy has sunk under restenergy. There is no charge-changing when energy-terms become negative, because the whole energy-term stays positive and its limit for time against infinitive becomes zero. If this advancement of classical SRT can be proven experimentally and if it is logically and physically consistent must be seen through measurement. A new or advanced physical theory always must be falsifable through measurements. [12.]. Classical seperated four-spacetimes of Minkowski-type with quadratic lineelement and its assigned topology and gravity resp. its classical causal spacetime-structure are described in detail in [13.]-[16.]. The mathematics required for the EWP can be found in [17.].

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8. Verification:

This paper is written without using a chatbot like ChatGPT-4 or other chatbots or AIs. It is fully human work in every word.
The dedication to open science is made in the interest of enriching our global cultural heritage, to promote free and libre science and culture around the world, and to give something back to the unrestricted and chargefree science-culture that has given all of us so much.

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Appendix A:

The detailed solution 1. for the complex eigenwertproblem (see (4.2)):

$$
\begin{aligned}
\Psi_0(t)=\;& e^{\frac{-W_d}{2\cdot\hbar}\cdot t}\cdot\left[\Psi_0(0)\cdot\begin{pmatrix}\cos\left(\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot t\right)\\ \frac{-W_d}{2\cdot\hbar}\cos\left(\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot t\right)-\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot\sin\left(\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot t\right)\end{pmatrix}\right]\\
&+e^{\frac{-W_d}{2\cdot\hbar}\cdot t}\cdot\left[\dot{\Psi}_0(0)\cdot\begin{pmatrix}\sin\left(\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot t\right)\\ \frac{-W_d}{2\cdot\hbar}\sin\left(\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot t\right)-\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot\cos\left(\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\cdot t\right)\end{pmatrix}\right]
\end{aligned}
$$

Picture 1: The complete detailed formula for the solution 1 of complex eigenwert-problem of two damped spacetimes for the case of weak damping.

With:

$$\Psi_0(0)=\begin{pmatrix}1\\ \frac{-W_d}{\hbar}\end{pmatrix} \tag{A1.}$$

Appendix B:

The detailed solution 3. for the real eigenwertproblem (see (6.5)):

$$\Psi_0(t)=\frac{\dot{\Psi}_0(0)-\left(\frac{-W_d}{2\cdot\hbar}-\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\right)\cdot\Psi_0(0)}{2\cdot\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}}\cdot e^{\left(\frac{-W_d}{2\cdot\hbar}+\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\right)\cdot t}$$

-

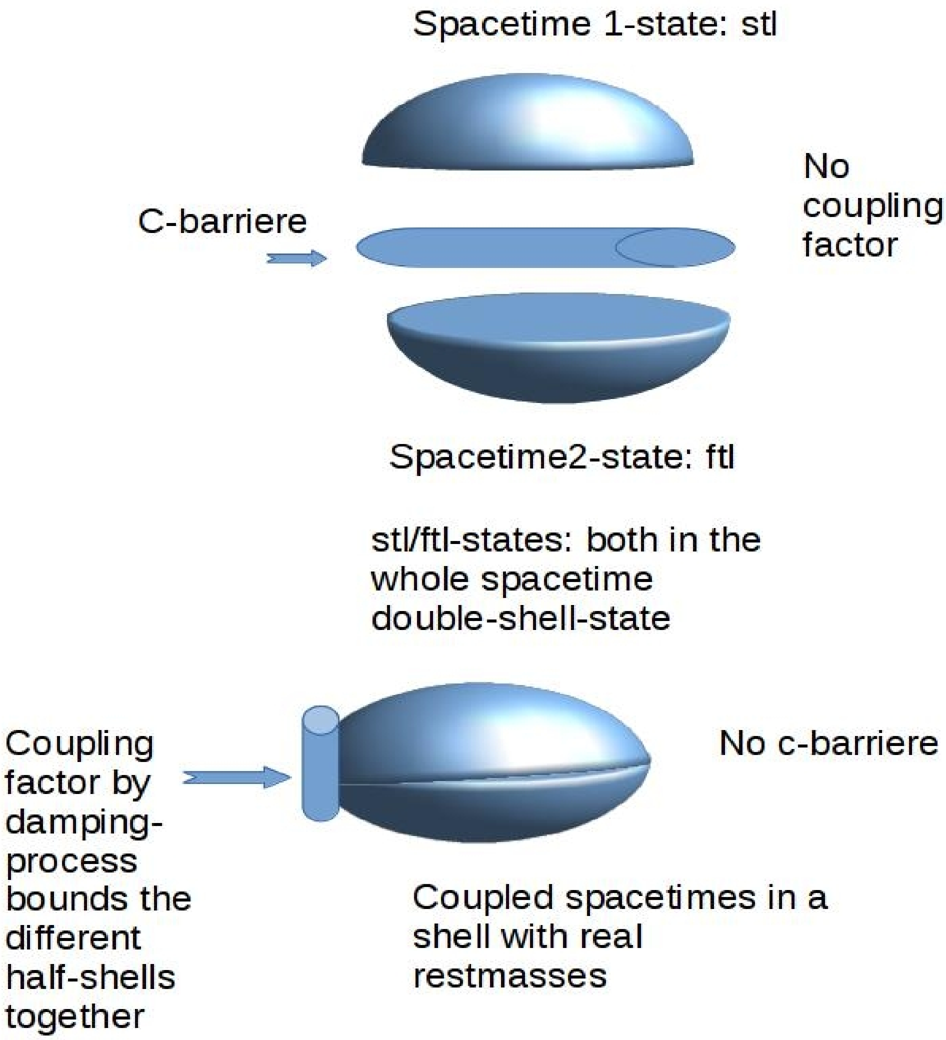
$$+\frac{\dot{\Psi}_0(0)-\left(\frac{-W_d}{2\cdot\hbar}+\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\right)\cdot\Psi_0(0)}{-2\cdot\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}}\cdot e^{\left(\frac{-W_d}{2\cdot\hbar}-\sqrt{\frac{(W_d)^2}{4\cdot\hbar^2}-\frac{\omega^2{}_{PL}\cdot\left(1-e^{i\cdot\frac{W_d}{\hbar}\cdot t}\right)}{A}}\right)\cdot t}$$

Picture 2: The complete detailed formula for the solution 3 of real eigenwert-problem of two damped spacetimes for the case of strong damping.

With:

$$\Psi_0(0)=\begin{pmatrix}1+\frac{\hbar\cdot\dot{\Psi}_0(0)}{W_d}\\ \frac{-\hbar\cdot\dot{\Psi}_0(0)}{W_d}\end{pmatrix} \qquad \text{(B1.)}$$

Appendix C:



Picture 3: Shown are the two uncoupled spacetimes in a model and the coupling of both through a damping-factor, causing ftl by real restmasses through producing a shell of this two spacetimes.