Классификация положений равновесия автономной системы

Умнов Е.А.

09 апреля 2020 г.

lesseisur cucrer 2-20 nopogua.
onp: cucieny represenve gupt, yp. run nazuberot abtoroverou,
$\vec{X}(t) = F(\vec{X})$, T.e. upabad 2acts ne zabucus Abnorm $\vec{X}(t) = \ \vec{X}_{t}(t)\ $ of payor of negabucurous neperennosi t ,
3 averance: repeguo nezabucunyno reperennyto t 370 i cucterno y crobno nazorbant 1, spereneri".
Barrerame: unorga vionino l'aperitto u gpyrol capegeneme abronomino
" repexogus & cedi upu npouzbonoux cyleurax byont our beerluy."
Prekrigno, 200 Fire ompegenement Fubuka nent non, econ pero 6 ovoux amparix riger o ricreviax 6 hoporamont of opere. U uz nux copazy me cuegyer bamunol about cribio.
Choicaboo: b-4 flt+c) Tome pemerul HteM, t+CEM (390u M-ruy-les un moropor paccionarphenerit pemerul unierus) u cregulone un soro choicaba:
u cregerleur un sous choiserla.
Cregistone: Tepes konggro Tozny gazobero ngo Panciba X, x X2 x x Xn abtonominat accievas apoxoget ogna 4 tonomo ogtas cogodad upubad.
(day but upular to hypochered uniterpantion reportor med day but aport para (6),
4 euge opes enegethee:
cregai bue: grazoland upuban abtonomoni cuccetto suso ne caronepecenaeras, undo cocioni no ognosi trotan, undo ebriletas zamungion upubori.

Dance knaccioquiaismo nonomenui probriobecius abronomius inserinos cuciem 2-20 nopogua paccinospum na konupestant repunepaxo

Thurse 1: $\begin{cases} \dot{x} = 2x - 2y \\ \dot{y} = -x + 3y \end{cases}$

Dannylo auterny rushino paecirat pubats nan zanom glenmennes torum na miocnocim (x, y) c reremens beenennt. X, i borchynaus l'unrecibe coorfercibytoryex nomnoment. Bentopa exopocim. Due tono, 2 tobby onpegennts morphism toria buonnerismont moment bremenn, penning gannyto auterny.

 $\begin{vmatrix} 2-h & -2 \\ -1 & 3-h \end{vmatrix} = \lambda^{2} 5h + 6 - 2 = \lambda^{2} 5h + 9 = (1-1)(d-4) = 0$ $\lambda_{1} = 1 \quad || \frac{1-2}{2} || \vec{S}_{1} = \vec{0}, \quad \vec{S}_{1} = || \frac{2}{1} || \quad \hat{J}_{2} = \frac{4}{9} || \frac{-2-2}{-1-1} || \vec{S}_{2} = \vec{0} = > \vec{S}_{2} = || \frac{1}{1} ||$ $\vec{X}(H) = C_{1} e^{\frac{1}{1}} || + C_{2} e^{\frac{1}{1}} || + C_$

Теперь проагализируем получениюм результая:

- my crs C1=C2=0 => \$\forall (t)=0 \ u \ \$\forall (t)=0

 374 vorus beings ocrane cd renogbirmnoci (t.e. no pomenie parbiobecus)

 Coorbe crbenno, wheen chazobyro paentopuro, cocto Dusyno uz ognorTornu.
- my cos C1 +0, C2 =0. Torga (*) Ibrillich napariet puteckung ypabremen aparion c napabalionyum beetopon [13], uporie torang (0,0) (notopal ne gochilaeta) Ul npu kanux znarenut x naparespet). Tanum sepazom, nymno pazawat cnyran C1>0 4 G<0 (ureen gbe dazobol Tpalutopum l lenge nonynpirux).
- anarowers, cuy can C=0, (2±0 3 agait gle roughpartel (

- octalted camoni, orlymi "engran 6, 40, (2+0)

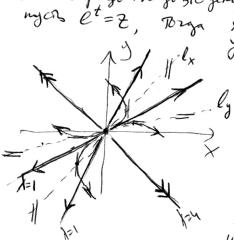
e= 0(e4+), LE U(+00) => xH) & C2e4/4/1 , t >+00; KH1>+0 , teu(-∞) => x'(+) ≈ c, e+ ||? || , t => -00 ||x||+) +0

T. e. " bravane brevien" (+6 Ú(-vs)) spazolad Traensopus výet " novih no kacatekoroù" ke ognoù uz "Sonee neg nevoux " npe nommetitox payolex Tpaentopuis

Topun glumeres norm napamento ognore uz " fores poex "norm.

dazoboix Tpaeuropunt.

B nportenizine reengy sture gbyord npeglababith logra-arm goodpanlacen no nempeportnocth. Montoraence y to Emist, kaming иненно образом осазо это зекать!



X(1) = 292+6274 =) X+ = 39 = JE)=42-C2+1 X-2]=302+4

(x=29) = K (x-1) 4 T. C. upu coorbercisbyrousers 3 avene noopgunas norgraen upuspuo upus suvedovo nua (C bossiron "bepunnon, pazyreeris

repriper nonomenus pobrioblicus, bornomen, eux gononnuis retthe rocipalture. A wrienno racige of hapy hypochetimus uzoumn (by uckognoù accieron) x=0=> y=x // lx

y=0=> y=x //ly

Πρανοπικετινιε φαχουνε πραεκτοριμι gener φαζουμο πιαποίτο τια 4 τεπρεετи. Ind πολποτοι φαχούο το πορίφεις σατατότριο 6 καπησιώ τείθερια παρικούστο πο οσμονί " beτότιε".

Uz paccymgenui buzno, 200 karectberenni xapautep pucyning onpegendaci benerovi in znanavni xapantepuctureckux zucen uckognori untervor. Den orbertenste, nongrenna "haptung", syget wiets mecro burga, norga 1,7/2, 1,1/20, 1, 1, 6 R 1, ≠1/2, 1, 1, 1, 1, 1, ER Dannoe novomeruse pobroblecut nazorbaeral regerosirubous T.u. 1; >0, i=1,7 "yzer", nowen (Moromenne palrobeaux regardilubo eun cynserbyer xois de ogua pazolos Tpalaropus, que Kotopori 1841/4 to non t > tos) Bareranne: XOTI GIL Enpegerenus xaparktepa ronomenug pobrobecus noxomgenus uzounum ne spedyetzi (gil) zitos tem ne renee ux nocipoleme abriletal ciporolinatios) penomengobannum. Deno 670M, 1270 270 « genebra" cnocol carronpobepuu. Ecun b npegorgyyux boungum birun gomyusenor aundun unu nelepno Sorn npuvienem uendum tazoboro nopipeta, 70, nau npadouno, brucats npegnonaraevori dazoboro nopipeta (274) uzoenuttor ne no nyrurca

Tpurep2: $\begin{cases} \dot{x} = -5x + 4y \\ \dot{y} = -x - y \end{cases}$ $\begin{cases} |-5 - \lambda| + |-1 - 1| = |\lambda|^2 + 6 |\lambda| + 5 + 4 = (d+3)^2 = 0 \\ |-1 - 1 - 1| = |-1 - 1| = |-1 - 1| = |-1 - 1| = 0 \end{cases}$ Crytain upasture gene fur evenue.

 $\vec{\chi}(t) = e^{-3t} (C_1 \|_1^2 \| + C_2 (t \|_1^2 \| + \|_0^{-1} \|))$

Daverame: ghe ogropognoù nun, cucrevur bee nperune, npoxogdurue zepez nazara noupgunar, shaltores uzonmnarm.

Hz 27020, 6 racinosti, areggis, 1=-3

TO be pazobne preciopulo 6 vocas

repecerenus oceci heopgunar, u revor

Ha hux // kacaterenus, 250 Tome

Tommo y recis nom no copoenim.

B gannon cuyrae, y recis // kacaterenus (70 cuax 4 a B.

x=0=> y=5x // x y=0=> y=-x // y

Paccono pennoni cuyrai (uparkou generative A)
nazorbaeru, вогрожденной узел Узел устой завой, Г.и. Ко

3 averaine: curron upations generous & published - " guepurarebum yzer" wreter buy IF roza & nergreb mocuasi dyger cover benson, orbernother & Thereps: $\begin{cases} \dot{x} = -x^{-2}y \\ \dot{y} = x + y \end{cases}$ $\begin{cases} |\dot{x}|^{-1-4} - \frac{2}{2}| + 1 = 0 \\ 1 - \frac{1}{2}| + \frac{2}{2}| + 1 = 0 \end{cases}$ Conpanience A. $\lambda = i \quad \| -1 - i - 2 \| \vec{S} = \vec{0} , \vec{S} = \| \vec{1} + i \|$ X(+) = C1 | -wst-siht | + C2 | | wst-siht | a notory gazolar paentopus 200 zamenzias uputar savether, 200 & moppinatar x=y, g=xxy bepro x2+g2=C1+c2, T. e. pazoboni nopiper tra modernoch (gy) 270 lucitera nongespureenux 3/Amral. Kanger napy apocietiem yourum (zdalnoe our sommoob 270 Упесенторные пражие угнов, образования этили азминати) x=0=> y=X //2 ÿ=0 => y=× 1/ly garrioni buy nonomerun probrobecue razorbattet. Hangalrenne " bpanjering " onjegendera zarrepor 6 npouglombrion Torne Corneron

T. C. " brausenne "aportib Eacobor

Thursepy: $\begin{cases} x = -3x - 2y \\ \dot{y} = x - y \end{cases} / \begin{vmatrix} -3 - \lambda - 2 \\ 1 & -1 - \lambda \end{vmatrix} = \lambda^2 + 4\lambda + 3 + 2 = 0$ D= 16-20=-4 1= -4+2i=-2+i Cityran Korenteccoo - conpamenter x 1 k= 2+i | 1-1-i -2 | 5=0, c rengator genciturent von 20076. $\vec{S} = ||\vec{1}||$ $\vec{S} = ||\vec{I}||$ $\vec{S} = ||\vec{$ Borpamenue & chookax colonagaes c npeguiguyar nouverpors i onucorbaes AMMIR, no reneps nouvertoyer renominante e⁻²⁴, no ropuit byges yverements guing paguy - fentopa c pocton t, a no rown breesto AMMIRCA porgraval compart. Cpasy wiser wyoumen a zaviepelen kanpolaenne " Epansenne" X=0=> y=-3x y=0 => y=x $\overrightarrow{X}|_{(1,0)} = ||\overrightarrow{J}||$ 1. l. " bpayerue" no Eacobor Стрений, при этом спираль "cupyrubaers", T.K. Re/(0 =) Cource При этом модум координат последовательность Toren nepecerenus ognos "Resur" c ocho (H-p) opquest ospazzest reo MET purecuyto represento (770 TU nurran Dunibea, norga purazion " palroviepro packpyruborouzyroci "company) $\frac{|\overrightarrow{OA}|}{|\overrightarrow{OB}|} = \frac{|\overrightarrow{X}(t)|}{|\overrightarrow{X}(t+\overrightarrow{X})|} = e^{|\overrightarrow{ImA}| \cdot \overrightarrow{II}} = e^{-2\overrightarrow{II}} e^{-2\overrightarrow{II}}$ Korya chupan Socipo cupyrulceor / pacapyru Soveres (was & gurinor august), 200 hig repuso, romino rapucobati negy "beron"

Therep 5: [x=+x+47] 1 1-d = 12-21=3=(A-1)(d+3)=0 Engrar gence burenbeux $\lambda_{i=-1} = \frac{2}{1} \frac{4}{2} \| \hat{S}_{i}^{2} = 0^{2}, \quad \hat{S}_{i} = \| \hat{S}_{i} \|$ A paynow znamb. Hazorlaerro ", cegro" $\vec{x}(t) = c_1 e^{-t} \|^2 \| + c_2 e^{3t} \|^2 \|$ * -7 -00 , x(t) ~ c,e-t||3,11 12/11/2100 , x1+12 (2e3+ 1/3/1 12/11/1-+00 ×+2y=462 23 => x-2y=461 => 9+2y=k (x-2y)= $X(z) = \frac{2c_1}{z} + 2c_2 z^3$ $y(z) = -\frac{G}{2} + c_2 z^3$ T. e. gayobre Tpaca Topum on upubore tuneps o nurection Tura, rope romnestare gazobbre pace. To pun Abritory gul nux accorno.

paccorospersory paccorospensory paccorospersory del massoria contratory uccurational nonomerous polonose and 270 uz munico (bee massoria contratory uzbectioning), b paccorospensoria mix ymrepax nonogunica sum gas unicorpersoria.

Barongenture cryran, nan republic, the Experience.

Then me I ware the year paction per carrocro-

X=0=> y=-x 1/2

j=0=> y=-x ///y