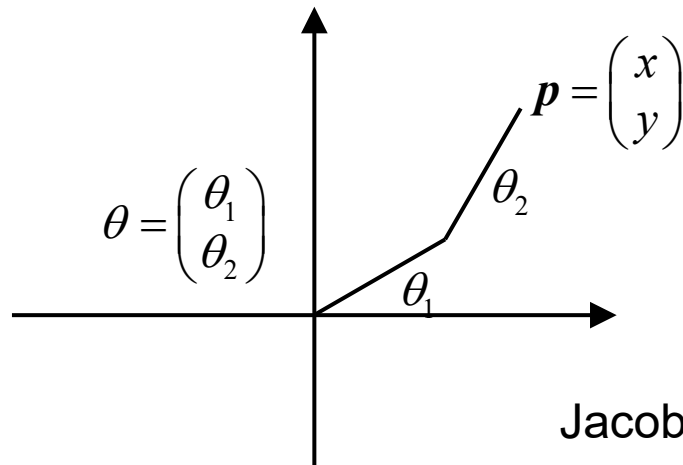


Robot Arm Model

(ロボットアームモデル)



Forward kinematics

$$x = L_1 \cos(\theta_1) + L_2 \cos(\theta_1 + \theta_2)$$

$$y = L_1 \sin(\theta_1) + L_2 \sin(\theta_1 + \theta_2)$$

Jacobian and inverse of Jacobian

$$\dot{\mathbf{p}} = \mathbf{J}\dot{\boldsymbol{\theta}}$$

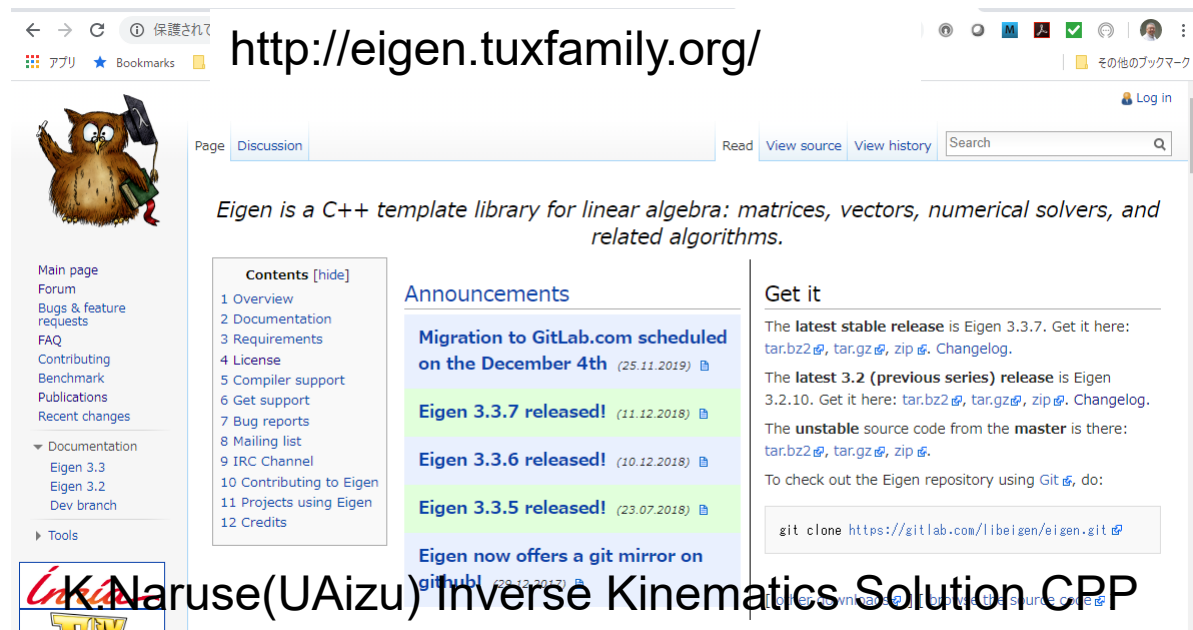
$$\mathbf{J} = \begin{pmatrix} j_{11} & j_{12} \\ j_{21} & j_{22} \end{pmatrix} = \begin{pmatrix} -L_1 \sin(\theta_1) - L_2 \sin(\theta_1 + \theta_2) & -L_2 \sin(\theta_1 + \theta_2) \\ L_1 \cos(\theta_1) + L_2 \cos(\theta_1 + \theta_2) & L_2 \cos(\theta_1 + \theta_2) \end{pmatrix}$$

$$\mathbf{J}^{-1} = \frac{1}{j_{11}j_{22} - j_{12}j_{21}} \begin{pmatrix} j_{22} & -j_{12} \\ -j_{21} & j_{11} \end{pmatrix}$$

Sample Codes for Numerical Calculation

(数値計算に関するソースコード)

Filename	Description
ik_2link_pure_cpp.cpp	Linear algebra is implemented with C++ (線形代数もC++のみで書かれている)
ik_2link_symJ_eigen.cpp	Linear algebra is implemented with Eigen, a c++ math library (線形代数はEigenで書かれている)



The screenshot shows the Eigen library website. The URL in the browser address bar is <http://eigen.tuxfamily.org/>. The page features an owl logo on the left. The main content area includes a navigation menu on the left with links like 'Main page', 'Forum', 'Bugs & feature requests', 'FAQ', 'Contributing', 'Benchmark', 'Publications', and 'Recent changes'. The central part of the page has a 'Contents' section with a list of links (1 Overview, 2 Documentation, 3 Requirements, 4 License, 5 Compiler support, 6 Get support, 7 Bug reports, 8 Mailing list, 9 IRC Channel, 10 Contributing to Eigen, 11 Projects using Eigen, 12 Credits). To the right of the contents is an 'Announcements' section with several news items, including 'Migration to GitLab.com scheduled on the December 4th', 'Eigen 3.3.7 released!', 'Eigen 3.3.6 released!', and 'Eigen 3.3.5 released!'. Below the announcements is a 'Get it' section with instructions on how to obtain the library and a code block showing the command to clone the repository: `git clone https://gitlab.com/libeigen/eigen.git`.

Sample Codes for Choreonoid

(コレオノイド用のコード)

Filename	Description
xy2link.body	Body file of 2-link arm for Choreonoid (2リンクロボットアームのボディファイル)
XY2link.Controller1.cpp	Simple controller of controlling a joint angle to (30, 30)[deg] (関節角度制御だけを行う)
XY2link.Controller2.cpp	Simple controller of controlling a joint angle which satisfies a hand position of (0.0, 0.1) (手先の位置に対する関節角度は別で計算され, ここでは関節角度制御だけを行う)
XY2link.Controller3.cpp	Simple controller of solving inverse kinematics in initialization() and controlling a joint angle to the solved one in control() (逆運動学はinitialization()で関節角度制御はcontrol()で実行する)
XY2link.Controller4.cpp	Simple controller of solving inverse kinematics and controlling a joint angle both in control() (逆運動学と関節角度制御の両者をcontrol() で実行する)

Let Look at Codes

(それでは, コードを見てみよう)