The fix-cm package*

Frank Mittelbach, David Carlisle, Chris Rowley, Walter Schmidt†

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Abstract

fix-cm improves the definitions of the Computer Modern font families.

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†Walter wrote fix-cm

1 Introduction

!! To use the fix-cm package, load it *before* `\documentclass`, and use the command `\RequirePackage` to do so, rather than the normal `\usepackage`:

```
\RequirePackage{fix-cm}
\documentclass ...
```

2 Using EC fonts (T1 encoding) makes my documents look different

No I'm not trying to collect any cites from the news group discussion on this topic. In a nutshell, if one adds

```
\usepackage[T1]{fontenc}
```

to a document that uses the Computer Modern typefaces, then not only the T1 encoding is used but the fonts used in the document look noticeably different. This is due to the fact that the EC fonts have more font series designs, e.g. a 14.4 pt bold etc and those get used in the standard `.fd` files, while with Computer Modern (in OT1 encoding) such sizes were scaled versions of smaller sizes—with a noticeable different look and feel.

So we provide a package fix-cm to ensure that comparable definitions are used. In addition to that, the package fix-cm also enables continuous scaling of the CM fonts. This package was written by Walter Schmidt.

2.1 What fix-cm does

Loading the package fix-cm changes the font definitions of the Computer Modern fonts, in order to achieve the following effects:

- The appearance of the T1 and TS1 encoded CM fonts (aka 'EC') is made as similar as possible to the traditional (OT1 encoded) ones. Particularly, a number of broken or ugly design sizes are no longer used, the look of the bold sans serif typeface at large sizes is considerably improved, and mismatches between the text fonts and the corresponding math fonts are avoided. As a side effect, PostScript and PDF documents may become smaller, because fewer fonts need to be embedded.
- The Computer Modern fonts are made available with arbitrary sizes.
- Only those design sizes of the fonts will be used, that are normally available in Type1 format, too. You need not load the extra package cmmib57 for this purpose.

The package acts on the following font families:

- The text font families `cmr`, `cmss`, `cmtt` and `cmvtt` with OT1, T1 and TS1 encoding.
- The default math fonts used by LaTeX, i.e., the font families `cmm` with encoding OML and `cms` with encoding OMS.

- The symbols used by the package latexsym, i.e., the font family `lasy`.

Note that the package does *not* act on:

- Font families such as CM Fibonacci, CM Dunhill etc., which are provided for experimental purposes or for fun only.
- CM text fonts with character sets other than Latin, e.g., Cyrillic. Loading of the required font and encoding definitions while the fonts are not actually used, would not be a good idea. This should be addressed by particular packages or by changing the standard FDs of these fonts.
- Extra math fonts such as the AMS symbol fonts. While they match the style of Computer Modern, they are frequently used in conjunction with other font families, too. Thus, fix-cm is obviously not the right place to make sure that they can be scaled continuously. Ask the maintainers of these fonts to provide this feature, which is badly needed!
- The math extension font `cmex`. Whether or not this font should be scaled is a question of its own, and there are other packages (exscale, amsmath, amsfonts) to take care of it.

2.2 How to load the package

!! The package should be loaded *before* `\documentclass`, using the command `\RequirePackage{fix-cm}`, rather than the normal `\usepackage`. Rationale: If the package is loaded in the preamble, a preceding package or even the code of the document class may have used any of the CM fonts already. However, the definitions of those fonts, that are already in use, cannot be changed any more.

2.3 Usage notes

In contrast to what you may expect, fix-cm does *not* ensure that line and page breaks stay the same, when you switch an existing document from OT1 to T1 encoding. The package does not turn off all of the additional design sizes in the EC fonts collection: Those, that contribute considerably to the typographical quality and do not conflict with the math fonts, are—indeed—used.

!! Be careful when using arbitrary, non-standard font sizes with applications that need bitmap fonts: You may end up with lots of possibly huge `.pk` files. Also, Metafont chokes sometimes on extremely small or large sizes, because of arithmetic problems.

fix-cm supersedes the experimental packages cmsd and fix-ec, which are no longer distributed.

The packages type1cm and type1ec must not be loaded additionally; they enable only continuous scaling.

3 Implementation

3.1 Preliminaries

The LaTeX kernel does not declare the font encoding TS1. However, we are going to set up font definitions for this encoding, so we have to declare it now.

```
⟨*fix-cm⟩
\input{ts1enc.def}
```

In case the package is loaded in the preamble, any of the CM fonts may have been used already and cannot be redefined. Yet we try to intercept at least the problem that is most likely to occur, i.e., a hidden `\normalfont`. Most of the standard definitions are ok, but those for T1 encoding and 10.95 pt need to be removed:

```
\expandafter \let \csname T1/cmr/m/n/10.95\endcsname \relax
\expandafter \let \csname T1/cmss/m/n/10.95\endcsname \relax
\expandafter \let \csname T1/cmtt/m/n/10.95\endcsname \relax
\expandafter \let \csname T1/cmvtt/m/n/10.95\endcsname \relax
```

fix-cm may still fail, if the EC fonts are preloaded in the LaTeX format file. This situation is, however, very unlikely and could occur only with a customized format.

The remainder of the package is enclosed in a group, where the catcodes are guaranteed to be appropriate for the processing of font definitions.

```
\begingroup
\nfss@catcodes
```

3.2 T1 encoding

CM Roman

```
\DeclareFontFamily{T1}{cmr}{}
\DeclareFontShape{T1}{cmr}{m}{n}{
        <-6>    ecrm0500
        <6-7>   ecrm0600
        <7-8>   ecrm0700
        <8-9>   ecrm0800
        <9-10>  ecrm0900
        <10-12> ecrm1000
        <12-17> ecrm1200
        <17->   ecrm1728
      }{}
\DeclareFontShape{T1}{cmr}{m}{sl}{
        <-6>    ecsl0500
        <6-7>   ecsl0600
        <7-8>   ecsl0700
        <8-9>   ecsl0800
        <9-10>  ecsl0900
        <10-12> ecsl1000
        <12-17> ecsl1200
        <17->   ecsl1728
      }{}
\DeclareFontShape{T1}{cmr}{m}{it}{
        <-8>    ecti0700
        <8-9>   ecti0800
        <9-10>  ecti0900
        <10-12> ecti1000
        <12-17> ecti1200
        <17->   ecti1728
      }{}
\DeclareFontShape{T1}{cmr}{m}{sc}{
```

```
        <-6>    eccc0500
        <6-7>   eccc0600
        <7-8>   eccc0700
        <8-9>   eccc0800
        <9-10>  eccc0900
        <10-12> eccc1000
        <12-17> eccc1200
        <17->   eccc1728
               }{}
\DeclareFontShape{T1}{cmr}{m}{ui}{
        <-8>    ecui0700
        <8-9>   ecui0800
        <9-10>  ecui0900
        <10-12> ecui1000
        <12-17> ecui1200
        <17->   ecui1728
      }{}
\DeclareFontShape{T1}{cmr}{b}{n}{
        <-6>    ecrb0500
        <6-7>   ecrb0600
        <7-8>   ecrb0700
        <8-9>   ecrb0800
        <9-10>  ecrb0900
        <10-12> ecrb1000
        <12-17> ecrb1200
        <17->   ecrb1728
      }{}
\DeclareFontShape{T1}{cmr}{bx}{n}{
        <-6>    ecbx0500
        <6-7>   ecbx0600
        <7-8>   ecbx0700
        <8-9>   ecbx0800
        <9-10>  ecbx0900
        <10-12> ecbx1000
        <12->   ecbx1200
      }{}
\DeclareFontShape{T1}{cmr}{bx}{sl}{
        <-6>    ecbl0500
        <6-7>   ecbl0600
        <7-8>   ecbl0700
        <8-9>   ecbl0800
        <9-10>  ecbl0900
        <10-12> ecbl1000
        <12->   ecbl1200
      }{}
\DeclareFontShape{T1}{cmr}{bx}{it}{
        <-8>    ecbi0700
        <8-9>   ecbi0800
        <9-10>  ecbi0900
        <10-12> ecbi1000
        <12->   ecbi1200
      }{}
\DeclareFontShape{T1}{cmr}{bx}{sc}{
        <-6>    ecxc0500
```

```
        <6-7>   ecxc0600
        <7-8>   ecxc0700
        <8-9>   ecxc0800
        <9-10>  ecxc0900
        <10-12> ecxc1000
        <12->   ecxc1200
      }{}
%
```

CM Sans

```
\DeclareFontFamily{T1}{cmss}{}
\DeclareFontShape{T1}{cmss}{m}{n}{
        <-9>    ecss0800
        <9-10>  ecss0900
        <10-12> ecss1000
        <12-17> ecss1200
        <17->   ecss1728
      }{}
\DeclareFontShape{T1}{cmss}{m}{sl}{
        <-9>    ecsi0800
        <9-10>  ecsi0900
        <10-12> ecsi1000
        <12-17> ecsi1200
        <17->   ecsi1728
      }{}
\DeclareFontShape{T1}{cmss}{m}{it}
       {<->ssub*cmss/m/sl}{}
\DeclareFontShape{T1}{cmss}{m}{sc}
       {<->sub*cmr/m/sc}{}
\DeclareFontShape{T1}{cmss}{sbc}{n}{
        <->     ecssdc10
       }{}
\DeclareFontShape{T1}{cmss}{bx}{n}{
        <-10>   ecsx0900
        <10->   ecsx1000
      }{}
\DeclareFontShape{T1}{cmss}{bx}{sl}{
        <-10>   ecso0900
        <10->   ecso1000
      }{}
\DeclareFontShape{T1}{cmss}{bx}{it}
       {<->ssub*cmss/bx/sl}{}
```

The following substitutions are not provided in the default `.fd` files. I have included them, so that you can easily use the EC fonts with the default bold series being `b` rather than `bx`.

```
\DeclareFontShape{T1}{cmss}{b}{n}
       {<->ssub*cmss/bx/n}{}
\DeclareFontShape{T1}{cmss}{b}{sl}
       {<->ssub*cmss/bx/sl}{}
\DeclareFontShape{T1}{cmss}{b}{it}
       {<->ssub*cmss/bx/sl}{}
```

CM Typewriter

```
\DeclareFontFamily{T1}{cmtt}{\hyphenchar \font\m@ne}
\DeclareFontShape{T1}{cmtt}{m}{n}{
        <-9>    ectt0800
        <9-10>  ectt0900
        <10-12> ectt1000
        <12-17> ectt1200
        <17->   ectt1728
      }{}
\DeclareFontShape{T1}{cmtt}{m}{it}{
        <-9>    ecit0800
        <9-10>  ecit0900
        <10-12> ecit1000
        <12-17> ecit1200
        <17->   ecit1728
      }{}
\DeclareFontShape{T1}{cmtt}{m}{sl}{
        <-9>    ecst0800
        <9-10>  ecst0900
        <10-12> ecst1000
        <12-17> ecst1200
        <17->   ecst1728
      }{}
\DeclareFontShape{T1}{cmtt}{m}{sc}{
        <-9>    ectc0800
        <9-10>  ectc0900
        <10-12> ectc1000
        <12-17> ectc1200
        <17->   ectc1728
      }{}
\DeclareFontShape{T1}{cmtt}{bx}{n}
       {<->sub * cmtt/m/n}{}
\DeclareFontShape{T1}{cmtt}{bx}{it}
       {<->sub * cmtt/m/it}{}
\DeclareFontShape{T1}{cmtt}{bx}{sl}
       {<->sub * cmtt/m/sl}{}
```

Substitutions not provided in the default `.fd` files:

```
\DeclareFontShape{T1}{cmtt}{b}{n}
       {<->sub * cmtt/m/n}{}
\DeclareFontShape{T1}{cmtt}{b}{it}
       {<->sub * cmtt/m/it}{}
\DeclareFontShape{T1}{cmtt}{b}{sl}
       {<->sub * cmtt/m/sl}{}
```

CM Typewriter (var.)

```
\DeclareFontFamily{T1}{cmvtt}{}
\DeclareFontShape{T1}{cmvtt}{m}{n}{
        <-9>    ecvt0800
        <9-10>  ecvt0900
        <10-12> ecvt1000
        <12-17> ecvt1200
        <17->   ecvt1728
      }{}
```

```
\DeclareFontShape{T1}{cmvtt}{m}{it}{
        <-9>    ecvi0800
        <9-10>  ecvi0900
        <10-12> ecvi1000
        <12-17> ecvi1200
        <17->   ecvi1728
      }{}
```

3.3 TS1 encoding

CM Roman

```
\DeclareFontFamily{TS1}{cmr}{\hyphenchar\font\m@ne}
\DeclareFontShape{TS1}{cmr}{m}{n}{
        <-6>    tcrm0500
        <6-7>   tcrm0600
        <7-8>   tcrm0700
        <8-9>   tcrm0800
        <9-10>  tcrm0900
        <10-12> tcrm1000
        <12-17> tcrm1200
        <17->   tcrm1728
      }{}
\DeclareFontShape{TS1}{cmr}{m}{sl}{
        <-6>    tcsl0500
        <6-7>   tcsl0600
        <7-8>   tcsl0700
        <8-9>   tcsl0800
        <9-10>  tcsl0900
        <10-12> tcsl1000
        <12-17> tcsl1200
        <17->   tcsl1728
      }{}
\DeclareFontShape{TS1}{cmr}{m}{it}{
        <-8>    tcti0700
        <8-9>   tcti0800
        <9-10>  tcti0900
        <10-12> tcti1000
        <12-17> tcti1200
        <17->   tcti1728
      }{}
\DeclareFontShape{TS1}{cmr}{m}{ui}{
        <-8>    tcui0700
        <8-9>   tcui0800
        <9-10>  tcui0900
        <10-12> tcui1000
        <12-17> tcui1200
        <17->   tcui1728
      }{}
\DeclareFontShape{TS1}{cmr}{b}{n}{
        <-6>    tcrb0500
        <6-7>   tcrb0600
        <7-8>   tcrb0700
        <8-9>   tcrb0800
        <9-10>  tcrb0900
```

```
        <10-12> tcrb1000
        <12-17> tcrb1200
        <17->   tcrb1728
      }{}
\DeclareFontShape{TS1}{cmr}{bx}{n}{
        <-6>    tcbx0500
        <6-7>   tcbx0600
        <7-8>   tcbx0700
        <8-9>   tcbx0800
        <9-10>  tcbx0900
        <10-12> tcbx1000
        <12->   tcbx1200
      }{}
\DeclareFontShape{TS1}{cmr}{bx}{sl}{
        <-6>    tcbl0500
        <6-7>   tcbl0600
        <7-8>   tcbl0700
        <8-9>   tcbl0800
        <9-10>  tcbl0900
        <10-12> tcbl1000
        <12->   tcbl1200
      }{}
\DeclareFontShape{TS1}{cmr}{bx}{it}{
        <-8>    tcbi0700
        <8-9>   tcbi0800
        <9-10>  tcbi0900
        <10-12> tcbi1000
        <12->   tcbi1200
      }{}
```

CM Sans

```
\DeclareFontFamily{TS1}{cmss}{\hyphenchar\font\m@ne}
\DeclareFontShape{TS1}{cmss}{m}{n}{
        <-9>    tcss0800
        <9-10>  tcss0900
        <10-12> tcss1000
        <12-17> tcss1200
        <17->   tcss1728
      }{}
\DeclareFontShape{TS1}{cmss}{m}{it}
       {<->ssub*cmss/m/sl}{}
\DeclareFontShape{TS1}{cmss}{m}{sl}{
        <-9>    tcsi0800
        <9-10>  tcsi0900
        <10-12> tcsi1000
        <12-17> tcsi1200
        <17->   tcsi1728
      }{}
\DeclareFontShape{TS1}{cmss}{sbc}{n}{
        <->     tcssdc10
       }{}
\DeclareFontShape{TS1}{cmss}{bx}{n}{
        <-10>   tcsx0900
```

```
        <10->   tcsx1000
      }{}
\DeclareFontShape{TS1}{cmss}{bx}{sl}{
        <-10>   tcso0900
        <10->   tcso1000
      }{}
\DeclareFontShape{TS1}{cmss}{bx}{it}
       {<->ssub*cmss/bx/sl}{}
```

Substitutions not provided in the default `.fd` files:

```
\DeclareFontShape{TS1}{cmss}{b}{n}
       {<->ssub*cmss/bx/n}{}
\DeclareFontShape{TS1}{cmss}{b}{sl}
       {<->ssub*cmss/bx/sl}{}
\DeclareFontShape{TS1}{cmss}{b}{it}
       {<->ssub*cmss/bx/sl}{}
```

CM Typewriter

```
\DeclareFontFamily{TS1}{cmtt}{\hyphenchar \font\m@ne}
\DeclareFontShape{TS1}{cmtt}{m}{n}{
        <-9>    tctt0800
        <9-10>  tctt0900
        <10-12> tctt1000
        <12-17> tctt1200
        <17->   tctt1728
      }{}
\DeclareFontShape{TS1}{cmtt}{m}{it}{
        <-9>    tcit0800
        <9-10>  tcit0900
        <10-12> tcit1000
        <12-17> tcit1200
        <17->   tcit1728
      }{}
\DeclareFontShape{TS1}{cmtt}{m}{sl}{
        <-9>    tcst0800
        <9-10>  tcst0900
        <10-12> tcst1000
        <12-17> tcst1200
        <17->   tcst1728
      }{}
\DeclareFontShape{TS1}{cmtt}{bx}{n}
       {<->sub * cmtt/m/n}{}
\DeclareFontShape{TS1}{cmtt}{bx}{it}
       {<->sub * cmtt/m/it}{}
\DeclareFontShape{TS1}{cmtt}{bx}{sl}
       {<->sub * cmtt/m/sl}{}
```

Substitutions not provided in the default `.fd` files:

```
\DeclareFontShape{TS1}{cmtt}{b}{n}
       {<->sub * cmtt/m/n}{}
\DeclareFontShape{TS1}{cmtt}{b}{it}
       {<->sub * cmtt/m/it}{}
\DeclareFontShape{TS1}{cmtt}{b}{sl}
       {<->sub * cmtt/m/sl}{}
```

CM Typewriter (var.)

```
\DeclareFontFamily{TS1}{cmvtt}{}
\DeclareFontShape{TS1}{cmvtt}{m}{n}{
        <-9>    tcvt0800
        <9-10>  tcvt0900
        <10-12> tcvt1000
        <12-17> tcvt1200
        <17->   tcvi1728
      }{}
\DeclareFontShape{TS1}{cmvtt}{m}{it}{
        <-9>    tcvi0800
        <9-10>  tcvi0900
        <10-12> tcvi1000
        <12-17> tcvi1200
        <17->   tcvi1728
      }{}
```

3.4 OT1 encoding

CM Roman

```
\DeclareFontFamily{OT1}{cmr}{\hyphenchar\font45 }
\DeclareFontShape{OT1}{cmr}{m}{n}{
        <-6>    cmr5
        <6-7>   cmr6
        <7-8>   cmr7
        <8-9>   cmr8
        <9-10>  cmr9
        <10-12> cmr10
        <12-17> cmr12
        <17->   cmr17
      }{}
\DeclareFontShape{OT1}{cmr}{m}{sl}{
        <-9>    cmsl8
        <9-10>  cmsl9
        <10-12> cmsl10
        <12->   cmsl12
      }{}
\DeclareFontShape{OT1}{cmr}{m}{it}{
        <-8>    cmti7
        <8-9>   cmti8
        <9-10>  cmti9
        <10-12> cmti10
        <12->   cmti12
      }{}
\DeclareFontShape{OT1}{cmr}{m}{sc}{
        <->     cmcsc10
      }{}
\DeclareFontShape{OT1}{cmr}{m}{ui}{
        <->     cmu10
      }{}
\DeclareFontShape{OT1}{cmr}{b}{n}{
        <->     cmb10
      }{}
```

```
\DeclareFontShape{OT1}{cmr}{bx}{n}{
        <-6>    cmbx5
        <6-7>   cmbx6
        <7-8>   cmbx7
        <8-9>   cmbx8
        <9-10>  cmbx9
        <10-12> cmbx10
        <12->   cmbx12
      }{}
\DeclareFontShape{OT1}{cmr}{bx}{sl}{
        <->     cmbxsl10
      }{}
\DeclareFontShape{OT1}{cmr}{bx}{it}{
        <->     cmbxti10
      }{}
\DeclareFontShape{OT1}{cmr}{bx}{ui}
      {<->sub*cmr/m/ui}{}
```

CM Sans

```
\DeclareFontFamily{OT1}{cmss}{\hyphenchar\font45 }
\DeclareFontShape{OT1}{cmss}{m}{n}{
        <-9>    cmss8
        <9-10>  cmss9
        <10-12> cmss10
        <12-17> cmss12
        <17->   cmss17
      }{}
\DeclareFontShape{OT1}{cmss}{m}{it}
      {<->sub*cmss/m/sl}{}
\DeclareFontShape{OT1}{cmss}{m}{sl}{
        <-9>    cmssi8
        <9-10>  cmssi9
        <10-12> cmssi10
        <12-17> cmssi12
        <17->   cmssi17
      }{}
\DeclareFontShape{OT1}{cmss}{m}{sc}
       {<->sub*cmr/m/sc}{}
\DeclareFontShape{OT1}{cmss}{m}{ui}
       {<->sub*cmr/m/ui}{}
\DeclareFontShape{OT1}{cmss}{sbc}{n}{
        <->     cmssdc10
      }{}
\DeclareFontShape{OT1}{cmss}{bx}{n}{
        <->     cmssbx10
      }{}
\DeclareFontShape{OT1}{cmss}{bx}{ui}
       {<->sub*cmr/bx/ui}{}
```

CM Typewriter

```
\DeclareFontFamily{OT1}{cmtt}{\hyphenchar \font\m@ne}
\DeclareFontShape{OT1}{cmtt}{m}{n}{
        <-9>    cmtt8
```

```
        <9-10>  cmtt9
        <10-12> cmtt10
        <12->   cmtt12
      }{}
\DeclareFontShape{OT1}{cmtt}{m}{it}{
        <->     cmitt10
      }{}
\DeclareFontShape{OT1}{cmtt}{m}{sl}{
        <->     cmsltt10
      }{}
\DeclareFontShape{OT1}{cmtt}{m}{sc}{
        <->     cmtcsc10
      }{}
\DeclareFontShape{OT1}{cmtt}{m}{ui}
       {<->ssub*cmtt/m/it}{}
\DeclareFontShape{OT1}{cmtt}{bx}{n}
       {<->ssub*cmtt/m/n}{}
\DeclareFontShape{OT1}{cmtt}{bx}{it}
       {<->ssub*cmtt/m/it}{}
\DeclareFontShape{OT1}{cmtt}{bx}{ui}
       {<->ssub*cmtt/m/it}{}
```

CM Typewriter (var.)

```
\DeclareFontFamily{OT1}{cmvtt}{\hyphenchar\font45 }
\DeclareFontShape{OT1}{cmvtt}{m}{n}{
        <->     cmvtt10
      }{}
\DeclareFontShape{OT1}{cmvtt}{m}{it}{
        <->     cmvtti10
      }{}
```

3.5 OML and OMS encoded math fonts

```
\DeclareFontFamily{OML}{cmm}{\skewchar\font127 }
\DeclareFontShape{OML}{cmm}{m}{it}{
        <-6>    cmmi5
        <6-7>   cmmi6
        <7-8>   cmmi7
        <8-9>   cmmi8
        <9-10>  cmmi9
        <10-12> cmmi10
        <12->   cmmi12
      }{}
\DeclareFontShape{OML}{cmm}{b}{it}{<-6>cmmib5<6-8>cmmib7<8->cmmib10}{}
\DeclareFontShape{OML}{cmm}{bx}{it}
       {<->ssub*cmm/b/it}{}
\DeclareFontFamily{OMS}{cmsy}{\skewchar\font48 }
\DeclareFontShape{OMS}{cmsy}{m}{n}{
        <-6>    cmsy5
        <6-7>   cmsy6
        <7-8>   cmsy7
        <8-9>   cmsy8
        <9-10>  cmsy9
```

```
        <10->   cmsy10
      }{}
\DeclareFontShape{OMS}{cmsy}{b}{n}{<-6>cmbsy5<6-8>cmbsy7<8->cmbsy10}{}
```

3.6 LaTeX symbols

```
\DeclareFontFamily{U}{lasy}{}
\DeclareFontShape{U}{lasy}{m}{n}{
        <-6>    lasy5
        <6-7>   lasy6
        <7-8>   lasy7
        <8-9>   lasy8
        <9-10>  lasy9
        <10->   lasy10
      }{}
\DeclareFontShape{U}{lasy}{b}{n}{
        <-10>   ssub * lasy/m/n
        <10->   lasyb10
      }{}

\endgroup
⟨/fix-cm⟩
```